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A testimonial to Varaztad Kazanjian

■ *Carl W. Waldron, M.D., D.D.S., Hopkins, Minn.*

It is indeed a privilege to be given the pleasant task of doing honor to my long-standing friend, Dr. Kazanjian. His story is the saga of American opportunity for those persons, born in other countries, who possess ability, ambition and determination to achieve success in a chosen endeavor. "Kay," as many of his close friends call him, was born in Armenia in 1879. For generations his family had been coppersmiths, which is the meaning of the name Kazanjian.

When Dr. Kazanjian was three years old, his father moved his large copper business from Erzinojan, which was under Turkish control, to a larger Armenian city, Sivas, seven days away by horse. There he established a copper foundry and business. In Sivas, "Kay" attended Protestant schools and later was taught by the French Jesuits. He received instruction in Arabic, Persian, Armenian and French, as well as in physics, chemistry and mathematics. Instruction in English was not available. The increasing Turkish measures of oppression created such an atmosphere of fear that Armenian history books were hidden behind basement foundation stones and were read only in secret.

While still in his early teens, Varaztad embarked on a ten day wagon trip over the mountains to be with an uncle in Sansun, a somewhat cosmopolitan city that was under Turkish rule. The town had been influenced by mid-European and Western European trade and culture, however. Varaztad worked for a couple of months as bookkeeper in his uncle's export business, but his training was not sufficient for this work. His uncle then secured a job for him in the Austrian Post Office of Sansun. At that time, several European countries maintained their own post offices in Sansun.

The Armenian patriots in England, France and Switzerland printed forbidden pamphlets and literature against the Turkish government and against Sultan Hamid and mailed them to fictitious names in care of the Austrian post office

Presented in behalf of the American Society of Oral Surgeons on the occasion of the presentation of the first American Society of Oral Surgeons Award to Dr. Kazanjian commemorating his contribution to the development of oral surgery, Hollywood, Fla., November 5, 1954.

where they were claimed by members of the Armenian patriotic groups. Young Varaztad and four other Armenian youths formed a junior group to work for the cause of freedom. His position in the post office was strategic, and frequently in the darkness before dawn he would distribute the pamphlets.

As might be expected, the Turkish authorities began an investigation to discover the source of the forbidden literature. Armenians considered guilty of acts against Turkey were imprisoned, exiled and sometimes put to death. Fortunately, Varaztad's uncle learned that he was under suspicion and arranged to have him smuggled on a ship sailing for Marseilles. Two older half-brothers accompanied him.

In France they joined an Armenian group which was en route to Cherbourg. The group was exploited by those arranging passage to America, and the 60 immigrants were crowded under intolerable conditions in one room on the ship.

At Ellis Island, Varaztad was held up for some days as the Immigration Service thought that a boy of 16 years might become a public charge. Since he had no knowledge of English, the situation was difficult. All he possessed was a slip of paper on which was written the name of an Armenian friend of the family who lived in New York City. Varaztad and his half-brothers learned at this time of the terrible massacres of Armenians by the Turks that had taken place shortly after their departure from Sansun. Later, however, they learned that their families had not been persecuted.

They proceeded to Worcester, Massachusetts, to the home of a fellow countryman. There Varaztad unsuccessfully sought work in the wire mills; however, he finally secured a job in a spring factory. Since he did not understand English or the method of recording his piece work, his first week's pay was 90 cents. The next week his work and mathematics improved, and he earned three dollars and subsequently six dollars for a ten hour day, six day week. The working conditions were unsanitary, the machinery was dangerous and there was no protection from dust and dirt. Some six months later he obtained employment in a wire mill and by working overtime earned up to $15 a week.

It soon became apparent to Varaztad that he must learn the English language, so he attended school five nights a week. He continued these studies for about seven years and he also read a great deal, attended lectures and took correspondence courses. After three years, as a result of the stress of work and study, he became ill and was forced to rest for a time. Later he worked in shoe factories in other towns, but returned to Worcester because of the greater opportunity for education in the night schools. He again took work in a wire factory.

On one occasion when a group of Armenian youths were on an outing, their future activities were discussed and one of the boys remarked that "dentistry is a good profession." The idea appealed to Varaztad and he directed his future studies toward this objective. From his meager earnings he paid for extra lessons from a tutor as well as for his tuition in night school. By 1901 he had saved $300 toward his objective, but he gave this money to his half-brother to enable him to return

V. H. Kazanjian and plaque presented to him by the American Society of Oral Surgeons, November 5, 1954

to Armenia to visit the families there; this was typical of Varaztad's great generosity.

He entered high school at the age of 22. Toward the conclusion of his second year of high school, he met Charles Smith, dean of the Harvard School of Dentistry, who, impressed by his deep desire to study dentistry, invited him to Boston to try the entrance examination. Varaztad passed this, entered the school and graduated in 1905. His freshman year was particularly discouraging because of the difficulty he had in expressing himself in English. A surprisingly good grade in one subject, however, spurred him on to greater efforts. His unusual finger dexterity helped him, and he was delegated to make teaching casts and models for the school. These he made on Saturdays and Sundays. In the summer he returned to Worcester to work in the wire mills.

After graduation his efforts to establish a practice were discouraging, and his financial problems were great. For a time he did dental laboratory work for former classmates. He was made a part-time instructor in prosthetic dentistry. His practice increased and gradually brought relief from his financial difficulties.

In 1912 he entered the Boston University School of Medicine but withdrew one year later to become head of the prosthetic department of Harvard Dental School. In 1915 he went overseas as dental chief of the First Harvard Unit to the British Expeditionary Forces in France. Soon thereafter, he was made an honorary major of the Royal Army Medical Corps

and was transferred to the nearby 20th British General Hospital in Camiers. There he organized and directed for the remainder of the war a large section for the treatment of facial and jaw injuries.

In the summer of 1916 I was sent to this hospital by the Surgeon General of the Canadian Expeditionary Force for duty and training. It was my first meeting with Varaztad, and here began our close friendship which has continued for more than 38 years. Dr. Kazanjian's outstanding skill in the care of facial injuries and fractured jaws, as well as his ingenious and effective splints, has become widely known. He received three citations from Field Marshall Sir Douglas Haig which were signed by Winston Churchill.

He returned to America in 1919 and enrolled in Harvard Medical School from which he graduated in 1921. During his final year, an incident occurred at one of Dr. Harvey Cushing's clinics. Two distinguished visiting officers of the Royal Army Medical Corps were scheduled to speak. Noticing Dr. Kazanjian among the students, they leaped up the amphitheater steps, grasped the arms of the reluctant student, brought him down to the platform and introduced him to his fellow students as the man who had taught them the technic they were demonstrating.

Since his early professional days, Dr. Kazanjian has been extremely active in the teaching field. He was chief of the department of oral surgery in the Harvard Dental School, and in the Medical School was professor of military oral surgery, clinical oral surgery and plastic surgery until the compulsory retirement age supervened. Since 1947 he has been professor emeritus of plastic surgery. He is a visiting lecturer in maxillofacial surgery in the graduate school of medicine of the University of Pennsylvania. He is a senior, life or honorary member of numerous special surgical societies and continues to participate actively in their annual programs.

His honors and citations are numerous; at a World's Fair he was included on an Honor Wall on which were inscribed the names of 650 foremost citizens, born in other lands, who had had distinguished careers in all walks of life in the United States. He was given a special honorary citation and plaque at the annual meeting of the American Society of Plastic and Reconstructive Surgery in 1951. Previously he had received awards from the American Academy of Dental Science and a scroll from the Rhode Island State Dental Society "for distinguished service to humanity."

His outstanding contributions to the literature of oral surgery are too numerous to mention. Many of the technics he has introduced are today standard procedures. In the early days of the JOURNAL OF ORAL SURGERY, as a member of the Editorial Board, he came to the rescue on numerous occasions with excellent manuscripts on very short notice.

Dr. Kazanjian is a humble, kindly man, loved by all who know him well. His lovely wife, Marion, is a most hospitable hostess at their fine home in Belmont. She is active in hospital and civic affairs. They have two charming daughters—Helene who is married to a Boston attorney, and Dr. Joan who is a resident in pediatrics. Their son, Victor, is a practicing attorney in Boston.

Advances in maxillofacial surgery during the past half century

■ *Varaztad H. Kazanjian, D.M.D., M.D., Boston*

Up to the time of World War I, traumatic surgery of the face and jaws probably was one of the minor surgical problems. Modern warfare, however, has resulted in types of injuries that had never before been seen in such quantity. Wounds inflicted by various kinds of projectiles tore the soft tissues apart and often penetrated the deeper structures, causing comminution of the bones. Ensuing infection resulted in further complications. During the early part of World War I, the hospital wards were filled with patients who suffered from badly infected wounds and many of these patients died.

The problem of wound infection has engaged the attention of the medical profession since the time of Hippocrates. A first important step in the control of infection was achieved when the bacterial origin of suppuration was discovered in the nineteenth century; this gave birth to what is known as the Listerian period. The destruction of bacteria by instillation of antiseptics in wounds was a significant advance; yet, despite all the benefits of antiseptic therapy, the results fell short of expectations. Strong solutions of phenol, cresol paste and other formulae were used freely, but wounds continued to suppurate. It was soon realized that antiseptics, powerful enough to destroy bacteria, damaged healthy tissues also and deprived them of their natural recuperative powers against infection.

The transition from the use of antiseptics to irrigation procedures was still another stride forward in the fight to control the spread of infection. Improved results were obtained by the use of lymphagogues in the form of hypotonic solutions of salt and magnesium sulfate. Carrel introduced the method of intermittent irrigation of wounds with a hypochloride solution.

Further studies disclosed that all fresh wounds were contaminated by bacteria, that these organisms, at first limited to the surface, penetrated the deeper tissues after a few hours, resulting in inflammation and the formation of pus. Such knowledge led to a more intelligent understanding and handling of wounds.

■ *Advances Between World War I and World War II*

Many lives have been saved because of the discoveries and advances that have been made between the first and second world wars. Research in the administration of local and general anesthesia has made it possible to operate on more pa-

The Chalmers J. Lyons Memorial Lecture, read before the American Society of Oral Surgeons, Hollywood, Fla., November 5, 1954.

tients and with greater safety. Progress has been made in the prevention and treatment of surgical shock, in methods of preserving blood and plasma, and knowledge regarding their use has been a tremendous step forward. Finally the discovery of chemotherapeutic agents and antibiotics for the prevention and treatment of infected wounds has increased the surgeon's effectiveness.

The discovery of antibiotics that are based on the natural combativeness of certain soil-dwelling microorganisms is without doubt the greatest achievement of the twentieth century. As one writer has said, it ranks equally with the introduction of general anesthesia in surgery in the nineteenth century. The use of antibiotics in the struggle against the spread of infection is an outstanding contribution of medical science and has resulted in a vast change in the treatment of wounds.

When World War II began, military medicine was equipped with new methods of prevention and treatment, and as a result the mortality rate was held to a minimum.

■ *Present Method of Treatment of Wounds*

Bacterial invasion through injured tissues is rapid, and even a fresh wound is immediately contaminated; however, it requires a few hours before infective organisms invade the deeper tissues and infection begins. To prevent suppuration and promote healing, the wound must be treated before harmful bacteria have the opportunity to increase tissue damage. Therefore, under either local or general anesthesia, thorough mechanical cleansing with sterile soap and water is the first important step. This is followed by flushing of the wound with a liberal amount of saline solution. Any remaining foreign bodies or blood clots are removed at this time. Débridement by careful excision of loose particles of tissue and contused surfaces of the wound is then carried out. Adequate hemostasis and elimination of dead spaces by means of buried sutures is the next important step. The skin margins can then be approximated with fine sutures, after which adequate pressure dressings are applied.

Wounds with gross loss of tissue cannot be repaired completely, but much can be done to facilitate and simplify future plastic procedures. Usually such wounds, especially those caused by projectiles, have smaller wounds radiating from the central one. Closure of the small wounds usually makes the general picture less complicated. One of the most useful procedures to promote healing of exposed, clean wounds deprived of skin covering is to apply a skin graft as a temporary measure.

■ *Late Primary Suturing*

If the wound is already infected and edematous, immediate suturing is not indicated. Such wounds should receive supportive treatment in the form of mechanical cleansing, hot fomentations, free drainage and judicial use of antibiotics. Experience has shown that such wounds can be made ready for suturing within a few days.

Although soft tissue wounds of the face are treated in a similar fashion to wounds in other parts of the body, certain favorable regional peculiarities must be considered. These include such factors

as the abundant blood supply to facial tissues which favors healing and the anatomic interrelationship of various facial structures. A penetrating wound that communicates with the oral cavity or the maxillary sinus is an instance in which the anatomic relationship is favorable because of the fact that drainage may be established.

The deformity that often follows such injuries is psychologically significant, for the face is an exposed part of the body and there may be a permanent disfigurement. This is an exceedingly important factor today since maxillofacial injuries occur more frequently in civilian life because of advances in high speed transportation and the development of new and often dangerous machines.

■ *Bone Injuries*

The treatment of fractures of the jaw has been of great interest to the dental profession for many years. Ingenious splints have been devised by dentists to immobilize displaced fragments of the jaws in correct dental occlusal relationships. Because the occlusion of teeth was recognized as a guiding factor in the treatment of such conditions, members of the dental profession were called on in World War I to treat fractured jaws that had resulted from war injuries; such bone injuries differed greatly from those seen in civilian practice. Some were compound or comminuted with occasional loss of a section of bone and many teeth. Despite the fact that war injuries of the jaws had been seen rarely by the generation of dentists in the early part of this century, members of the dental profession were able to improvise dental splints and devise new methods and technics to meet the unusual demands made on them.

The greatest of the earlier contributions of the dental profession in the surgical treatment of traumatic injuries of the jaws was the fundamental concept that broken jaw fragments should be immobilized to harmonize with the occlusal relationships of the patient's teeth, and that when part of the jaw was missing, the remaining fragments should be immobilized in accordance with the dental occlusion. When this fundamental rule was violated by surgeons whose primary object was to insure bony union, impaired masticatory function and facial deformity were often the result. Unfortunately, even today, patients are seen occasionally who have facial disfigurements that are directly attributable to treatment that has failed to preserve the correct occlusal relationships of the teeth.

Additional contributions of dentists to the treatment of fractured jaws include the construction of splints which utilize existing teeth as points of anchorage for immobilization, and development of appliances which replace lost sections of bone, preparatory to surgical procedures. If only the long bones of the body were also equipped with sturdy pegs which protrude through the skin and could be used as points of anchorage, the orthopedic surgeon would have a far more efficient means of immobilizing fractures.

Great progress in the treatment of fractured jaws has been made during the past 50 years, for the oral and maxillofacial surgeons have modified the earlier procedures. Modern methods of immobilization of maxillary and mandibular fractures are quite different from those which

employed the earlier interdental splints. Surgical procedures such as intraosseous wiring of fragments and circumferential wiring as an aid in fixation play an additional role in the treatment of fractured jaws, but the use of oral splints fastened to existing teeth still remains the most important method to obtain immobilization.

■ *Correction of Deformities of Face and Jaws*

Since World War I, reconstructive surgery of the face has become one of the major interests of the maxillofacial surgeon. Because the facial contour is supported by underlying bony structures, injury may affect the skeletal as well as the softer tissues of the face.

Early adequate treatment of minor injuries of the face often eliminates the need for additional treatment at a later time or minimizes resulting deformities, thus simplifying future reconstructive procedures. Some conditions, however, require further reconstructive measures despite all efforts. The aim of reconstructive treatment is to restore the normal contour of the face and to re-establish efficient mastication, unobstructed breathing and deglutition. Defects of the soft tissues are corrected either by means of skin grafts or by pedicled flaps.

SKIN GRAFTS—Skin grafting was used as early as 1869 by Reverdin, Ollier, Thiersch and Wolfe, but was employed more frequently after 1920 when Blair and Brown demonstrated the usefulness of these grafts in the treatment of burns. Today the method is used most often in the treatment of injuries which involve the skin covering of the body. The introduction of the Padgett dermatome and other mechanical devices that facilitate the removal of skin grafts has increased the usefulness of skin grafting in instances where only skin loss exists.

Extensive research is being carried on with various types of skin grafts. Earlier experiments consisted of transplanting skin from one person to another, and it was found that homografts "take" as easily as autografts but unfortunately are rejected within a few weeks. Blood grouping apparently does not have any relation to the "take" of the homograft. However, even though homografts are eventually rejected, skin from a healthy person may be used to cover raw areas in a person who has suffered great loss of skin from burns. This procedure does not require a long surgical procedure; therefore, a homograft can be used as a temporary dressing until the patient is able to stand further operative procedures.

The mechanism of dissolution of homografts is interesting. The gradual absorption is not accompanied by elevation of temperature, inflammation or suppuration. At the present time, a great deal of experimental work is being done to find out why homografts are rejected. It appears that the proteins in the homograft are antigenic, and as soon as the host builds up sufficient concentration of antibodies in the body, the homograft begins to become resorbed. So far, only homografts in identical twins appear to survive permanently.

PEDICLED FLAPS—The various forms of skin grafts are exceedingly valuable as life-saving measures and for the repair of wounds and deformities in which the loss

of tissue is limited to the skin alone (such as in burns). Skin grafts, however, do not contain subcutaneous tissue. Lacking fat, they do not afford enough bulk to give sufficient contour, and for that reason the surgeon is often obliged to utilize pedicled flaps to repair deformities.

The pedicled flap has been known for many hundreds of years; Indian rhinoplastic methods are an early example of the procedure. Considerable literature on the subject existed prior to World War I; however, interest in the use of such flaps to supply deficient soft tissues of the face increased during and after the war, and a number of modifications of earlier procedures were developed. Other progressive steps included the intelligent use of delayed flaps to stimulate vascularity and viability of the flap and transposition of tissue from distant parts of the anatomy. Such procedures were made possible by the Gillies tube flap.

REPAIR OF BONE DEFECTS—The contour of the face, as well as other parts of the body, depends on the intact support of the underlying skeletal framework. When a part of the bony structure of the face is destroyed, the re-establishment of facial contour and function depends on adequate replacement of the tissues. This has been achieved by prosthetic devices and by bone grafts.

The dental profession has a long history of achievement in the construction of maxillofacial prostheses. A mechanical device to close a palatine defect was advocated by Alexander Petronius in the eighteenth century. Ambroise Paré made use of appliances to close palatal defects, and ingenious devices were made and reported by Kingsley, Claude Martin and many others for patients with congenital deformities such as cleft palate, or with defects resulting from the removal of malignant growths.

Among war casualties were a great many patients who had lost part of the maxilla or mandible. Reconstruction of the bony framework was necessary in order to support the softer tissues of the face. In the early days of World War I it became apparent that prosthetic support for mutilated jaws was essential before additional plastic surgery procedures were undertaken. Such appliances proved their usefulness not only as a temporary measure but also occasionally as a permanent support for the tissues of the face. In more recent years, however, transplants of bone have supplanted the use of prosthetic devices to a considerable degree.

During World War I, the use of bone for the repair of skeletal defects became an accepted method for treating ununited mandibular fractures. Delageniere employed osteoperiosteal grafts taken from the tibia, and Lindemann made use of grafts taken from the crest of the ilium. Gillies, Waldron, Risdon, Blair, Ivy and others have made additional important contributions which facilitated the wider use of bone grafts for the repair of skeletal defects of the face.

Bone grafts are employed today in the reconstruction of such conditions as skull defects, nasal deformities and zygomatic depressions. The replacement of lost portions of the mandible by bone grafts is an extremely useful procedure; it has been possible to restore two thirds of a missing mandible with an iliac bone graft. Campbell has used bone grafts suc-

cessfully to restore missing parts of the maxilla.

Investigations dealing with homologous bone grafts and the preservation and storage of bone grafts continue. At present, however, it is the feeling among most orthopedic surgeons that the autogenous bone graft is preferable because of the greater percentage of success that has been obtained with them. Maxillofacial surgeons are not justified in using preserved cartilage or bone or any foreign substance when the supply of autogenous bone is abundant and the results are so dependable.

■ *Comment*

This brief review of the advances that have been made in maxillofacial surgery during the past half century indicates a number of the advantages which have become the property of the younger surgeons of today. This additional knowledge and the more complete understanding of the surgical problem, however, places a greater degree of responsibility on the younger generation of surgeons who will not only emulate but will surpass the earlier pioneers.—475 *Commonwealth Avenue.*

Bilateral multilocular follicular cysts of the maxilla and mandible

■ *Jack B. Caldwell,* D.D.S., M.Sc., San Francisco, and Henry C. Thompson,† D.D.S., Washington, D. C.*

The occurrence of multilocular follicular cysts involving all four third molar regions in the same patient is rare and presents a diagnostic problem. Since this condition is suggestive of a generalized bone disease, complete history and laboratory examinations are necessary, as well as a clinical examination and roentgenographic surveys.

A review of the literature reveals several cases of multiple follicular cysts in one individual. Limberg[1] in 1925 reported the case of a 21 year old girl with follicular cysts involving all four third molars. Oliver[2] in 1934 reported a case in which follicular cysts were found around all four third molars, the maxillary cuspids, and

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†Major, Dental Corps, U. S. Army; resident in oral surgery, Walter Reed Army Hospital, Washington.

1. Limberg, A. A case of multiple follicular cysts. D. Cosmos 67:343 April 1925.

2. Oliver, C. H. A case of multiple dentigerous cysts. Brit. D. J. 57:591 Dec. 1, 1934.

the mandibular right second bicuspid. Bennett[3] in 1937 reported a case in which follicular cysts were found around the crowns of impacted maxillary cuspids, an impacted mandibular incisor, and the mandibular left third molar. Seeman[4] in the same year reported a case in which the right maxillary second and third molars, the maxillary left third molar, and the mandibular second and third molars bilaterally were involved in cysts. Boyko, Surgent, and Mohnac[5] reported the case of a 45 year old woman with follicular cysts involving the mandible bilaterally. Myers[6] in 1943 reported a case involving the mandibular third molars. Shelfstein[7] in 1943 reported a patient with three cysts —one in the anterior maxillary region and two involving the mandibular second and third molars bilaterally. MacGregor[8] in 1949 described the case of a 29 year old man in whom dentigerous cysts involved the unerupted first, second, and third maxillary molars, bilaterally, and the mandibular second bicuspids, first, second, and third molars bilaterally. Catania[9] in 1952 reported the case of a 19 year old girl who had six follicular cysts, one of which recurred.

Follicular cysts have been observed which follow a familial tendency. Beyrent[10] in 1938 reported the occurrence of follicular cysts in four members of one family of seven. Thoma and Blumenthal[11] in 1946 reported the occurrence of follicular cysts in four generations of a family of 30 members. Twelve of these had one to three cysts each.

In the case presented here there was evidence strongly suggestive of generalized bone disease with multilocular cystic areas in the maxilla and mandible.

■ *Report of Case*

The patient, a 22 year old edentulous white man, complained of recurrent swelling and spontaneous drainage of foul tasting fluid from the right maxillary buccal sulcus.

HISTORY OF PRESENT ILLNESS—From a review of the patient's previous hospital records and history elicited from the patient, it was found that in June 1952 he first noticed a swelling in the mucobuccal fold in the right maxillary region which had subsided without treatment. In October 1952 the swelling had recurred. It was incised and a purulent drainage was obtained. In January 1953 he again sought treatment because of "foul taste in his mouth." Clinical examination revealed an oroantral fistula in the right maxillary region from which there was a purulent exudate. Roentgenograms taken at that time revealed a third molar in the right maxillary sinus. An attempt to remove this tooth had been unsuccessful.

On January 25, 1953, the patient was transferred to another hospital for removal of the tooth. At that time a more

3. Bennett, P. H. Multiple dentigerous cysts: report of case. J.A.D.A. 24:894 June 1937.

4. Seeman, G. F. Report of four follicular cysts—dentigerous. Internat. J. Orthodont. 23:1138 Nov. 1937.

5. Boyko, G. V.; Surgent, J. W., and Mohnac, A. M. Bilateral dentigerous cyst of mandible. J.A.D.A. 28:1226 Aug. 1941.

6. Myers, P. B. Bilateral dentigerous cysts of mandible. Brit. D. J. 74:66 Feb. 5, 1943.

7. Shelfstein, I. H. L. Multiple cysts of the jaws. Am. J. Orthodont. & Oral Surg. (Oral Surg. Sect.) 29:452 Aug. 1943.

8. MacGregor, A. B. Multiple dentigerous cysts. Brit. D. J. 79:63 Aug. 3, 1945.

9. Catania, A. F. Report and comment on unusual case of multiple follicular cysts with recurrence. Oral Surg., Oral Med. & Oral Path. 5:895 Aug. 1952.

10. Beyrent, J. R. Multiple dentigerous cysts in four members of one family. J.A.D.A. 25:623 April 1938.

11. Thoma, K. H., and Blumenthal, F. R. Heredity and cyst formation. Am. J. Orthodont. & Oral Surg. (Oral Surg. Sect.) 32:273 May 1946.

Fig. 1—Suggestion of "wooly hair" change which was interpreted as normal variant

complete examination, including roentgenograms of the skull, sinuses, hands, and long bones disclosed multiple large, clear, cystlike lesions on both sides of the mandible and a tooth in each maxillary sinus. There was also a "wooly hair" appearance in the skull and faint translucent punched-out areas in the distal ends of both femurs (Fig. 1). Several tiny cystlike areas were seen in the roentgenograms of the hands. The pituitary fossa was reportedly clear and the falx cerebri showed calcification. Previous laboratory examinations had been within normal limits.

PHYSICAL EXAMINATION—The patient was a well developed, 196 pound, 6 foot 4 inch white man in no acute distress. Systemic examination was noncontributory except for an impairment of nasal breathing due to a deviated septum. There was a purulent discharge from a fistula in the buccal fold of the right edentulous maxillary second molar region. The remainder of the oral examination was not remarkable. There was one café au lait spot on the abdomen.

LABORATORY DATA—Blood studies performed on admission revealed a white blood cell count of 6,100 and a red blood cell count of 4,750,000; 83 per cent neutrophils, 12 per cent lymphocytes, 4 per cent monocytes and 1 per cent eosinophils. The hemoglobin was 13.9 Gm. or 89 per cent. The sedimentation rate was 12 mm. per hour, and the hematocrit was 44 mm. Total protein was 8 mg. per 100 cc.; albumin 3.4 Gm. per 100 cc.; globulin 4.6 Gm. per 100 cc.; calcium 11 mg. per 100 cc.; inorganic phosphorus 3.9 mg. per 100 cc.; alkaline phosphatase 5.4 Bodansky units and acid phosphatase 0.2 Bodansky units. The urinalysis revealed negative sugar, negative albumin, and a specific gravity of 1.020. The urine was negative for Bence Jones protein and the serology was negative.

ROENTGENOGRAPHIC EXAMINATION—Roentgenograms of the mandible and nasal accessory sinuses revealed multilocular radiolucent areas in the mandible, bilaterally, and a tooth high in each maxillary sinus (Fig. 2 and 3). This latter finding suggested follicular cysts involving both antrums. The left maxillary sinus was completely clouded, while the right revealed evidence of aeration superiorly. The left mandibular third molar was inverted and displaced to the anteroinferior portion of the ascending ramus in a compartmented radiolucent lesion which extended from the first bicuspid area to the sigmoid notch (Fig. 4). The cystlike

lesion in the right side of the mandible extended from the first molar area to the sigmoid notch; no tooth was present (Fig. 5).

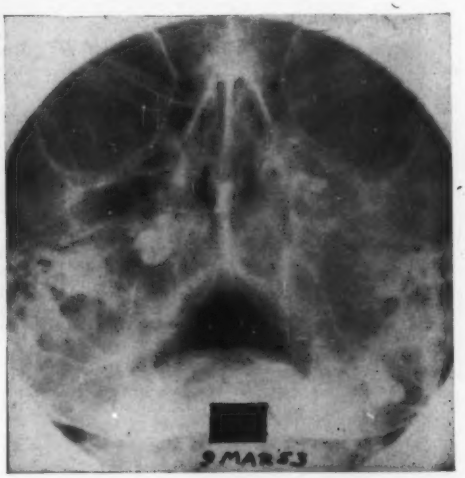
Roentgenograms of the long bones, skull, pelvis, and hands revealed the previously noted changes, but these were interpreted as normal variants.

COURSE IN HOSPITAL—A biopsy of the right mandibular cystic region was performed under local anesthesia on February 20, 1953. A portion of the bone surrounding the region and a portion of the cystic wall were removed for histopathologic examination. A diagnosis of follicular cyst was returned. An endocrinology consultation reported normal growth and development, and an otorhinolaryngeal consultation reported an acute rhinitis.

On March 10, 1953, with nasoendotracheal intubation and nitrous oxide, oxygen, ether and 2.5 per cent thiopental sodium anesthesia, all four follicular cysts and the three displaced teeth were removed by an intraoral approach. The maxillary cysts were removed through windows prepared in the lateral walls of the maxilla bilaterally above the first molar regions. These incisions were closed primarily. The sinuses were packed with petroleum jelly gauze through nasal antrostomy bilaterally. The mandibular cysts were enucleated and the defects were packed lightly with no attempt at primary closure. The patient withstood the procedure well, and his postoperative course was uneventful. There was little postoperative swelling despite the removal of all four cysts in one operation. The antibiotics administered included streptomycin, 250 mg. every six hours, and 600,-

Fig. 2—Preoperative roentgenogram showing multilocular lesions in mandible and inverted, displaced left molar involved

Fig. 3—Displaced teeth in right and left maxillary antrums and in left side of mandible



000 units procaine penicillin twice a day for 11 days. The nasal packings were removed on the second postoperative day. The mandibular dressings were removed on the fourth postoperative day and replaced with bismuth, iodoform, and petrolatum gauze dressings which were changed periodically thereafter. On the forty-second postoperative day there was clinical evidence that both antrums were closed from the mouth and the mandibular wounds were closing normally. The patient was returned to duty on April 28, 1953.

FOLLOW-UP EXAMINATION—The patient returned for final observation on July 9, 1953. The maxillary incision lines were well healed and roentgenograms revealed a fine trabecular pattern in the mandibular defects. An otorhinolaryngeal consultation reported the antral windows open and the nasal examination negative. Roentgenograms of the maxillary sinuses revealed the left antrum to be well aerated and the right antrum smaller but well aerated (Fig. 6).

PATHOLOGY REPORT—Examination of the enucleated cysts removed on March 10, 1953, revealed the lining of the cysts to be composed of stratified squamous epithelium and the contents to be keratin (Fig. 7). A moderately intense chronic inflammatory infiltrate was found in the soft tissues. The pathological diagnosis was multiple follicular cysts of the maxilla and mandible.

■ *Discussion*

Follicular cysts are ectodermal epithelial odontogenic cysts and are classified by Thoma, Robinson and Bernier[12, 13] into

12. Thoma, K. H. Diagnosis and treatment of odontogenic and fissural cysts. Oral Surg., Oral Med. & Oral Path. 3:961 Aug. 1950.

13. Thoma. K. H. Oral pathology, ed. 3. St. Louis, C. V. Mosby Co., 1950, p. 936.

Fig. 4—Preoperative lateral roentgenogram of left side of mandible demonstrating extent of lesion and position of inverted molar

Fig. 5—Lateral view of right side of mandible. No tooth was involved in this lesion

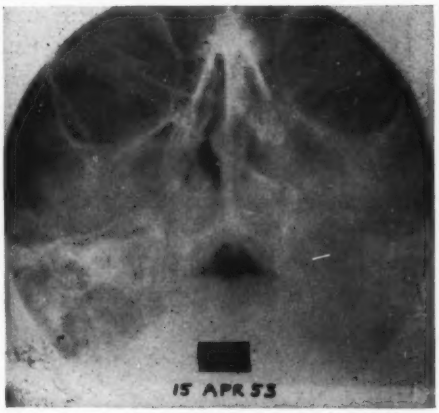
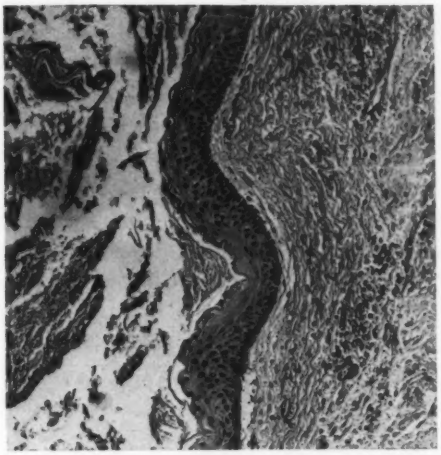


Fig. 6—Postoperative roentgenograms revealing evidence of aeration of both antrums

Fig. 7—Photomicrograph demonstrating well-differentiated squamous epithelium lining of the cysts



primordial, dentigerous and multilocular. Multilocular follicular cysts are thought to be formed when several tooth buds become cystic and coalesce as they enlarge. They are also believed to arise from sprouts from the dental lamina or outer epithelial layer, forming multiple cystic follicles which, because of the confining space, coalesce as they become larger.

The most frequent site of formation is in the third molar area, but they are rare bilaterally. Such a bilateral occurrence is suggestive of a generalized bone disease. In the case presented here the roentgenographic interpretation of the bone changes in the skull, femurs, hands, bilaterally in the mandible, and the displaced teeth in the maxillary sinuses strongly suggested a generalized bone disease. This was ruled out by the biopsy finding of a follicular cyst in the right side of the mandible with no pathologic condition in the surrounding bone, the interpretation of the roentgenographic bone changes in the skull, femurs and hands as normal variants, the normal blood chemistry, and the lack of supportive evidence in the history and symptoms.

Cardiac resuscitation

■ *Seymour Alpert, M.D., Washington, D. C.*

Cardiac arrest and ventricular fibrillation occur about once in every 5,000 surgical procedures.

The three points that must be kept in mind are: (1) prevention—the occurrence should be avoided if possible; (2) recognition—the condition should be diagnosed promptly; (3) resuscitation measures should be instituted at once.

■ *Prevention*

There are many causes of cardiac arrest and ventricular fibrillation, some avoidable, others not. Among these causes are the following:

Patients sometimes exhibit an idiosyncrasy, particularly for cyclopropane and chloroform; this occurs also with ethyl chloride and vinyl ether. At the time the patient is receiving these other agents, the administration of epinephrine should be avoided since it may cause ventricular fibrillation.

Anoxia acts as a myocardial depressant and can lead to cardiac arrest if prolonged. Cardiac muscle and nervous tissue do not tolerate anoxia and are readily damaged. Prolonged periods of anoxia lead to irreversible tissue changes.

Toxic doses of anesthetic agents result in depression of the myocardium. This is particularly true of patients with co-existing anoxia and pre-existing heart disease.

Reflex activity—particularly vago-vagal reflexes in the presence of anoxia—may occur during endotracheal intubation and extubation, tracheal aspiration, or gastric dilatation after positive pressure breathing; or from periosteal, pleural, bronchial, and hilar reflexes during thoracic surgery. Reflex mechanisms may play an important part during celiac plexus traction, carotid sinus manipulation, high spinal anesthesia, periotoneal reflexes, and ocular surgery.

Pre-existing heart disease may set the stage for cardiac difficulties during surgical procedures. In such cases anoxia is to be avoided particularly.

Mechanical interference with heart action, by injury, traction or pressure, may be fatal. An embolism and coronary occlusion must always be considered.

It is imperative for the anesthetist to choose anesthetic agents judiciously, use them carefully, avoid anoxia at all times, and be on the alert constantly for the development of cardiac arrest and recognize it promptly.

The surgeon should always bear in mind the possibility that cardiac arrest might occur and see that his patient is in the best possible physical condition prior to surgery; also he must try to avoid the production of vagovagal reflexes and heed promptly the first signs or warnings of cardiac difficulty.

Read before the meeting of the International Academy of Anesthesiology, May 13, 1953, George Washington University Hospital, Washington, D. C.

■ *Recognition*

The prompt recognition of cardiac arrest or ventricular fibrillation is of extreme importance. There are only three to four minutes available for the institution of resuscitative measures.

The absence of peripheral pulse, associated with a lack of recognizable blood pressure or heart sounds, closely followed by dilating pupils, and blanching of the skin are the indications that can be noted instantly. The surgeon can check for both pulse and pressure by palpating a large artery in the operative field.

■ *Treatment*

As soon as the diagnosis is made, the anesthesiologist must maintain positive pressure oxygen insufflation. This is easily done by squeezing the breathing bag of the gas machine. If the airway is obstructed, an endotracheal tube should be inserted, but oxygen by positive pressure must be administered until all is in readiness for intubation.

The surgeon must open the chest as quickly as possible in the fourth left interspace and begin cardiac massage immediately. At no time is the administration of oxygen interrupted. The technic of cardiac massage depends on the individual case. A small heart can be massaged with one hand, thumb in front and fingers behind. Usually one hand in front and one behind compressing the heart gives better results. One operator can massage at the rate of 40 to 60 times per minute, while two or more operators can massage the heart 80 to 100 times per minute. The procedure is tiring unless operators alternate.

The use of drugs should be limited. Epinephrine, 1 cc. of 1:1,000 diluted to 10 cc. with saline, may be injected in a dose of 1 cc. into the right auricle or right ventricle to increase the strength of contraction. Too much epinephrine may cause ventricular fibrillation, so overdosage should be avoided. In case of ventricular fibrillation, 3 to 5 cc. of 2 per cent procaine may be injected into the left ventricle, but the best therapy is electric shock to effect defibrillation.

The electrodes of the defibrillator are applied to the right ventricle just below the right auricle and to the apex of the left ventricle. Ordinarily, 60 cycle 110 volt current goes to an isolation transformer, then goes to a variac—a variable voltage transformer set at 130 volts so as to deliver 1.4 amperes. The foot switch is touched for about ⅓ second; if the heart is not shocked into standstill this single shock is repeated a few times; that is, 3 to 6 serial shocks are given, each shock lasting about ⅓ second with ⅓ second intervals. As long as cardiac massage is carried out and adequate oxygenation maintained, the emergency situation is under control. Then and only then should other measures be instituted.

All possible measures should be taken to avoid cardiac standstill or ventricular fibrillation since they are usually easier to prevent than to cure. However, if such an emergency arises all members of the surgical, anesthesia, and nursing team should be cognizant of this situation and know exactly what to do immediately after the diagnosis is made.

As stated earlier, only three to four minutes are available for diagnosis and for effective treatment of patients for whom cardiac resuscitation is needed. After this

time, permanent brain damage will result; and after six or eight minutes, a fatality may be anticipated.

■ *Oxygen Therapy*

Oxygen therapy is indicated in the various types of anoxia. In the anoxic type, where there is less oxygen in the inspired air; in the anemic type, where there is less circulating hemoglobin to carry the oxygen; in the stagnant or hypokinemic type, as occurs in congestive heart failure; in the histotoxic type, as occurs in cyanide poisoning; or in the case of overutilization, such as in high fever or thyrotoxicosis, or for any combination of these types of anoxia, oxygen therapy is beneficial.

The primary agent used in inhalation therapy is oxygen.

Carbon dioxide 5, 7, or 10 per cent and oxygen 95, 93 or 90 per cent mixtures are marketed as Carbogen, but this type is not indicated for the treatment of anoxia.

Helium, 60 or 80 per cent, used in combination with oxygen, 40 or 20 per cent, is indicated in respiratory distress resulting from bronchial asthma or any obstructive laryngeal or tracheal lesion. An ordinary oxygen gauge can be used, but the reading must be multiplied by 1.5 to get the helium-oxygen flow. These mixtures should be administered by BLB oronasal mask, not by the use of a catheter or oxygen tent.

The simplest method for giving oxygen therapy utilizes the nasal catheter. The tip of the special oxygen catheter must be properly placed at the level of the uvula, and concentrations up to 50 per cent oxygen can be obtained easily, using a flow of 5 to 7 liters per minute.

The most effective method for administering oxygen therapy is with the BLB mask or OEM meter mask. Concentrations of 50 to 100 per cent oxygen can be obtained when a tight fitting mask is used and an adequate flow of oxygen given. Usually a flow of 6 or 8 liters per minute is needed to keep the bag from collapsing on inspiration.

The oxygen tent is most expensive to use, but the most comfortable for the patient. The tent requires careful attention and oxygen analysis should be made at least three times daily. A properly set up tent, using a starting flow of 15 liters per minute, decreasing to a 10 liter flow, should give concentrations up to 50 per cent oxygen.

The meter positive pressure mask of Barach and Eckman is used in relieving pulmonary edema, and may be of some help for patients with severe asthma and in cases of obstructive lesions of the larynx and trachea. Air and oxygen are mixed in definite proportions—oxygen percentages of 45 to 100 can be obtained with this method and 1 to 4 cm. water pressure may be regulated on expiration.

■ *Resuscitative Measures*

The type of treatment given naturally depends on the location of the patient when resuscitation is needed. In the operating room, equipment is immediately available, and the anesthesia gas machine is the most readily available and best method for giving positive pressure oxygen. Lost fluids, blood or electrolyte solutions should be replaced by the intravenous or intraarterial route. Circulatory stimulants, sympathomimetic agents

or digitalis preparations may be indicated; analeptic agents are not recommended.

If resuscitation is needed when the patient is in his room in the hospital, equipment is always available within a few minutes. The use of oxygen by catheter, mask or tent is suggested for the patient who is breathing, and intermittent positive pressure oxygen by the Kreiselman Bellows Resuscitator or Kreiselman Adult Resuscitator for the patient who has ceased to breathe. The electrophrenic respirator, the suck and blow type of resuscitator, the Emerson and Drinker respirators and inhalators may be used where indicated. Circulatory depression may be treated by placing the bed in the Trendelenburg position and starting intravenous fluids.

If resuscitative measures are needed outside the hospital where mechanical equipment is not available, artificial respiration must be started manually at once. The Holger-Nielson technic is the one now universally recommended with the Silvester method next in preference. The Schafer prone pressure method gives inadequate tidal exchange and is not a method of choice. The Thompson hip-lifting method, incorporated in the Emerson, Ivy, Schafer method is also efficient.

■ *Summary*

The primary factor in cardiac resuscitation is immediate recognition of circulatory and respiratory depression. Resuscitative efforts should be started at once, and a definite routine of fluids and drug administration and mechanical treatment must be followed judiciously. Of paramount importance is the establishment and maintenance of a patent airway. This allows adequate pulmonary ventilation to assure effective oxygenation and elimination of excess carbon dioxide. Circulation should be supported carefully, and resuscitative efforts should be synchronized with the patient's own breathing. Cardiac massage, when indicated, should be carried out efficiently and at once.

The technics of inhalation therapy and resuscitation are mastered easily. Thorough knowledge of these methods and the prompt application in time of need may save a life.—*George Washington University Hospital.*

■ SCIENCE AND PROGRESS

Science, by itself, provides no panacea for individual, social and economic ills. It can be effective in the national welfare only as a member of a team, whether the conditions be peace or war. But without scientific progress, no amount of achievement in other directions can insure our health, prosperity and security as a nation in the modern world.—*Vannevar Bush.*

Radio-osteomyelitis of the jaw

■ *Harry M. Seldin, D.D.S.; S. Daniel Seldin, D.D.S.; William Rakower, D.D.S., and Abbe J. Selman, D.D.S., M.S., New York*

The mandible or maxilla usually is in the path of radiation whenever oral malignancies are irradiated.[1] As a consequence the bone may undergo radionecrosis. If osteomyelitis is then superimposed on radionecrosis of the jaw bone, the result is a complicated chronic condition which resists therapy.

This condition differs from osteomyelitis in bone that has not been irradiated previously; it is more severe, intractable and persistent. Its symptoms are pain, swelling, trismus, oral exposure of necrotic bone with delayed sequestration, abscess and sinus formation, pathologic fracture, and slowness of repair.

The pain may be acute and persist for many months. This usually is the patient's major complaint. The swelling and trismus may be as persistent as the pain, often contributing for long periods to the discomfort of the patient, interfering with his nutrition and well being. Oral exposure of bone is frequent. Many months may pass after its appearance before a portion of exposed bone is completely separated from the adjacent vital bone. Sequestration is prolonged because radiation has decreased the vitality of the adjacent noninfected tissues. Abscesses may recur repeatedly over a long period of time. Indolent sinuses form and remain, despite therapy. The abscesses and sinuses demand almost continuous treatment. Pathologic fracture may occur here as it does in uncomplicated osteomyelitis. This will depend on how much bone is destroyed and the kind of stress to which the bone is subjected. The repair of such fractures is exceedingly slow because of the decreased vitality of the surrounding tissues.

■ *Terminology*

Osteomyelitis superimposed on radionecrosis of bone generally is incorrectly referred to as "osteoradionecrosis." When so used, this term is neither sufficiently descriptive nor properly employed since it refers only to the death of bone from irradiation. Any bone, when heavily irradiated, suffers devitalization. The superimposition of osteomyelitis on radionecrotized bone, however, is a condition which may occur soon after irradiation, or it may not appear until several years afterward. This combination of circumstances has been reported as early as two months and as late as 12 years after radiation therapy.[2] In most instances the condition does not occur; it has been reported as appearing only in about 13 per cent of a large series of cases irradiated for oral cancer.[3] It must

1. Cook, T. J. Late radiation necrosis of the jaw bones. J. Oral Surg. 10:118 April 1952.

2. Cernea, P., and Bataille, R. Les alterations dentaires provoquees par la radio-therapie ou la Curietherapie de la region cervicale. Rev. de Stomatologie 48:34 Aug.-Sept. 1947.

3. Watson, W. L., and Scarborough, J. E. Osteoradionecrosis in intraoral cancer. Am. J. Roentgenol. 40:524 Oct. 1938.

be emphasized, however, that the condition in question is not merely the devitalization of bone caused by radiation; it is the total picture created by a combination of radionecrosis of bone plus osteomyelitis. For these reasons the condition is best designated by the term "radio-osteomyelitis," a term first used by Jacobsson.[4]

■ *Etiology*

The development of radio-osteomyelitis of the jaw depends on two major factors: (1) intensity of radiation; (2) infection of irradiated bone.

RADIATION—The intense radiation of varying degree which is used in the treatment of malignancies devitalizes bone. Such bone recovers slowly and maintains a decreased vitality thereafter. It also may offer diminished resistance to infection for indefinite periods. At first this effect was ascribed to interference with bone nutrition. It was thought to be the result of obliteration of vascular channels.[5] Later investigations have shown, however, that the irradiation has a destructive effect directly on the bone and marrow cells, the intraosseous vascular network and the reticular stroma.[6] It is possible that secondary radiations, given off by the irradiated calcium in bone, also destroy the osteoblasts and capillaries of the periosteum.

In some instances the soft tissues overlying bone undergo postirradiation sloughing. Only infrequently, however, is such intense radiation used as to produce this effect. The majority of patients treated by radiation for intraoral cancer exhibit a radioepithelitis of the mucosa and a dryness of the buccal cavity. The latter condition may persist for several months. When the mouth or pharynx is irradiated, there is an early increased secretion of thin mucus. Later the patient experiences discomfort because of a thick, adherent mucus[7] which is associated with a persistent dryness of the mouth and a metallic taste. Investigation has shown that radiation alters the normal histology of the oral mucosa. In particular the mucous glands are affected. The glands undergo a metaplasia which leads to hyperplasia and then obliteration.[8] This explains the persistent dryness of the mouth.

In addition to its effect on bone and soft tissue, radiation may injure the periodontal membrane and the supportive bone.[6] The periodontal changes and mobility of the teeth may require their extraction. An increase in the incidence of caries, particularly cervical caries, is a problem which may be added to a brittleness and friability of the enamel.[9] The effect of radiation on the dental pulp[10] also increases the possibility of apical infection.

INFECTION OF IRRADIATED BONE—Because of the alteration of histologic structure as a result of irradiation, the soft tissues lose their normal resistance and

4. Jacobsson, F. Carcinoma of the tongue. A clinical study of 277 cases treated at Radium-hemmet, 1931-1942. Acta Radiologica, sup. 68, 1948.

5. Ewing, J. Tissue reactions to radiation. Am. J. Roentgenol. 15:93 Feb. 1926.

6. Burstone, M. S. Effect of x-ray irradiation on the teeth and supporting structures of the mouse. J. D. Res. 29:220 April 1950.

7. Friedman, M., and Hall, J. W. Radiation-induced squamous-cell metaplasia and hyperplasia of normal mucous glands of the oral cavity. Radiology 55:848 Dec. 1950.

8. Lawrence, E. A. Osteoradionecrosis of the mandible. Am. J. Roentgenol. 55:733 June 1946.

9. Cutler, M. Problem of extractions in relation to osteoradionecrosis complicating radiotherapy for intraoral cancer. Oral Surg., Oral Med. & Oral Path. 4:1077 Sept. 1951.

10. Warren, S. Effects of radiation on normal tissue. Arch. Path. 35:121 Jan.; 35:304 Feb. 1943.

reparative abilities. Any type of trauma may cause these tissues to slough and retract, thus exposing the underlying irradiated bone to oral contaminants. The irradiated bone also may be infected through the blood stream or by periodontal or apical infection. Contamination of bone also may occur prior to irradiation or afterward through invasion by infected carcinomatous tissue.

■ *Prevention of Radio-osteomyelitis*

In many instances radio-osteomyelitis of the jaw may be prevented by proper dental management prior to and after irradiation.

PREIRRADIATION MANAGEMENT—It is generally believed that all infected and carious teeth should be removed prior to irradiation; it is also agreed generally that all normal teeth in the path of radiation should be extracted beforehand.[9] There are some, however, who believe in rendering the entire mouth edentulous prior to irradiation,[8,11-14] and others who completely oppose preirradiation extraction. The latter group feel that time is lost in waiting for healing and that the trauma involved in extraction may cause the disease to spread.[15-17] In our opinion, all infected and carious teeth and all teeth in line of radiation should be removed prior to treatment. Obviously, such decisions must be made in consultation with the radiation therapist. It should be remembered, however, that a postextraction healing period is always necessary before therapy is begun. When protracted radiation is to be used, a 3 to 4 day waiting period is adequate since the early small radiation doses will not affect healing. When the massive radiation technic is to be employed, however, there must be a 7 to 10 day postextraction healing period before the start of therapy.[18]

POSTIRRADIATION MANAGEMENT — Every possible effort must be made to avoid extractions for at least eight months after irradiation. After therapy, extraction is hazardous because of the delayed healing of the tissues. In such instances it has been suggested that prophylactic root canal therapy be employed.[3] The patient also must be helped to maintain the health of the oral tissues through proper mouth hygiene. The radioepithelitis and dry mouth with the metallic taste may be helped through the frequent use of mild mouthwashes. Rough fillings and poorly fitted dentures must be corrected. When teeth become painful as a result of irradiation, analgesics may be prescribed. Should extraction of a tooth become absolutely unavoidable, full utilization of antibiotic therapy and the utmost care and delicacy in handling of tissues are in order.

■ *Management of Radio-osteomyelitis*

Extreme conservatism of treatment must be adhered to when radio-osteomye-

11. Cade, S. Malignant disease and its treatment by radium, ed. 2. Bristol, John Wright & Sons, Ltd., 1949.
12. Schultz, M. D. Supervoltage roentgen therapy in cancer of the mouth and throat. Radiology 55:52 July 1950.
13. Smith, J. B. Cancer of the floor of the mouth. J. Oral Surg. 6:106 April 1948.
14. Trotter, W. Some principles in surgery of the pharynx. Lancet 2:833 Oct. 17, 1931.
15. Paterson, R. Treatment of malignant disease by radium and x-rays. Baltimore, Williams & Wilkins Co., 1948.
16. Quick, D. Discussion of E. M. Daland's Surgical treatment of post-irradiation necrosis. Am. J. Roentgenol. 46:30 Sept. 1941.
17. Sarnat, B. G., and Schour, I. Oral and facial cancer. Chicago, Year Book Publishers, 1950.
18. Rosh, Reva. Personal communication.

litis already exists. The major complaint usually is acute pain. Analgesics should be employed in the majority of such cases. Narcotics are to be avoided, where possible, since the condition usually is protracted. When drugs are ineffective against the pain, long-acting local anesthetics or alcohol nerve blocks may be used for prolonged relief.

Sequestra should be handled very conservatively. It is wise to avoid removal of them until clinical and roentgenographic evidence shows that the dead bone is completely detached. A line of separation may not become visible roentgenographically for several months. When bone becomes exposed it should be irrigated freely. Sharp, free ends of such exposed bone may be clipped off with rongeur forceps. Antibiotics should be used over long periods to prevent spread of infection.

Should a pathologic fracture occur, it is best to use simple, nontraumatic measures to keep the fragments in position. Vigorous movements, such as are necessary to remove attached sequestra, are contraindicated. With spontaneous separation of the sequestrum, reunion of the fragments is slow, but usually will occur.

Radical measures are at no time advisable. Conservatism is the essence of treatment of radio-osteomyelitis.

The following two case histories will illustrate this point.

CASE 1—A 49 year old man appeared on July 7, 1945, complaining of a "growth" of two months' duration in the floor of the mouth. Examination revealed a walnut-sized mass near the opening of the right Wharton's duct. There was considerable infiltration of the floor of the mouth, and right submaxillary lymph nodes were palpable. A specimen of the lesion taken for microscopic examination was reported as "highly infected epidermoid carcinoma, Grade III."

The patient was referred to a radiation therapist and an oncologist for consultation. Radiation therapy was decided on, and between July 16 and July 27 the patient received 2,000 r each to the right and left submaxillary regions. On July 30, under local anesthesia, radium needles were inserted in and about the lesion and in the right submaxillary nodes. The oral lesion received a total of 1,608 mg. hours and the submaxillary node 576 mg. hours. Considerable soft tissue reaction to radium followed. When the patient was seen by his radiation therapist in September, the malignant lesion had disappeared, but an additional 1,000 r were administered to the submental lesion because of residual swelling.

The patient did not return to this office again until December 1945. At that time he complained of excessive calculus deposits and sensitivity of the teeth, but he was advised to use only palliative treatment. In January 1946 the patient complained to his radiation therapist of increasing pain in the lower jaw and was referred back to us for a nerve block. The following month the patient returned to our office with signs of a bone reaction to radiation. Intraoral roentgenograms showed early radiolucency of alveolar bone, particularly the alveolar crests, in the lower anterior and the right bicuspid and molar regions. Palliative treatment again was recommended.

In April 1946, when the patient was seen again, a sloughing of the sublingual mucosa anteriorly and in the lower right bicuspid and molar regions was evident. The patient stated that he had had a dental prophylaxis two weeks previously and had felt pain in the tongue soon after. Alveolar resorption was even more evident on a roentgenogram, and there were large, fixed palpable nodes on both sides of the neck.

Because of these developments the radiation therapist advised further radiation therapy locally and surgery for the neck nodes. The therapist proceeded to administer additional radiation. This was followed by severe pain associated with swelling of the tongue. Within the same week the patient chose to employ the services of another oncologist. This physician treated the patient solely by irrigating the sloughed area in the floor of the mouth for the next six months. No further radiation therapy was administered.

In September 1946 the patient again came to our office. At this time he exhibited exposed bone lingually from the lower right molar to the region of the central incisors. The anterior teeth were mobile, and roentgenograms revealed not only resorption of alveolar bone but of the lingual plate (Fig. 1, left) in the lower central region as well. Palliative treatment was prescribed, and it was arranged that the patient be seen at monthly intervals.

In January 1947 the patient developed an acute infection in the lower right molar and bicuspid regions. Roentgenographic examination revealed considerable diffuse involvement of the alveolar bone (Fig. 1, center and right). Surgical interference was considered to be unavoidable at this time, and in anticipation of surgery, the patient was put on penicillin for several days. The lower teeth, from the lower right first molar to the lower left cuspid, were then removed, as was the already loose necrotic lingual plate. The patient was maintained on penicillin therapy, and at several subsequent visits sharp edges of lingual plate were trimmed with rongeur forceps.

From March 1947 to October 1949 the patient experienced recurrent infec-

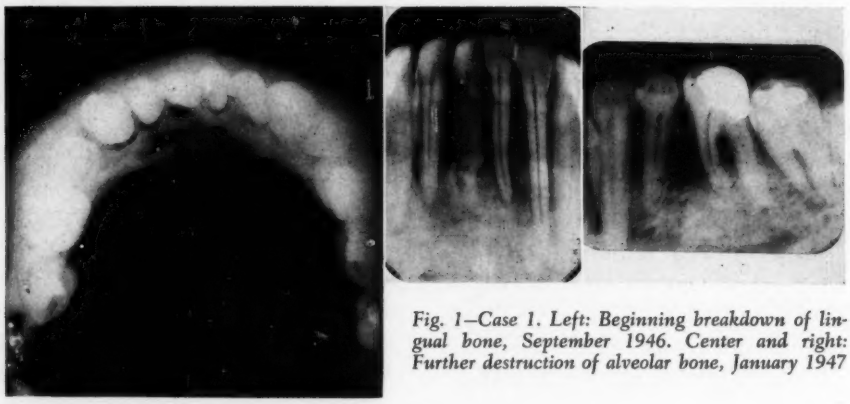


Fig. 1—Case 1. Left: Beginning breakdown of lingual bone, September 1946. Center and right: Further destruction of alveolar bone, January 1947

tions with abscess and fistula formation in various parts of the lower jaw. These recurrences necessitated repeated courses of penicillin therapy. Sequestra appeared repeatedly in various regions and required removal. The patient was not discharged until June 1950 at which time the mucous membrane was intact, there was no evidence of a pathologic condition in the bone and there had been no symptoms for eight months. Almost five years had elapsed from the time of the patient's first appearance. The patient has been asymptomatic for more than three years and has been wearing a lower denture that has functioned satisfactorily (Fig. 2).

Fig. 2—Case 1. Final loss of bone and teeth because of radio-osteomyelitis, November 1952

CASE 2—In April 1948 a 52 year old man was referred to us by his dentist for consultation. According to the patient's history, he had first felt a vague pain in the edentulous lower right second molar region in January 1948. In March 1948 his dentist, after the patient had made several visits for observation, "scraped the bone" in this region, but the pain had not disappeared, and the area of exploration had not healed.

Examination at this office revealed an unhealed, ulcerated lesion, approximately 1 cm. in diameter, in the edentulous lower right second molar region. No cervical nodes were palpable. A tentative diagnosis of carcinoma was made. Roentgenograms of the mandible and chest were negative. A specimen was taken of the soft tissues of the lower right molar region, and it was sent to the laboratory for microscopic examination. This was reported as being a "squamous cell carcinoma, Grade III-IV."

The patient refused to submit to surgery, as recommended by an oncologist, and he was referred to a radiation therapist for treatment. The therapist requested extraction of the lower right first molar, second and first bicuspid, and the lower left second bicuspid. The lower left second bicuspid was a crowned pulpless tooth. Extractions were done May 10, 1948, and the patient was referred back to his radiologist. Contrary to our recommendation, therapy was started the same day. From May 10 to June 23, 1948, both extraoral and intraoral roentgen therapy was directed to the lesion. The extraoral field received 4,000 r and the intraoral field received 3,700 r. The patient was then seen by the radiation therapist at irregular intervals.

In July 1948 exposed bone was seen at the site of the original lesion (Fig. 3, above left). Some pieces were sequestrated from this region in the course of the next few weeks, and severe pain developed along the right side of the face and extended to the ear. Intraoral roentgenograms showed delayed healing of the lower right first molar socket, with a radiolucent area in the lower right second molar region. Palliative treatment was recommended,

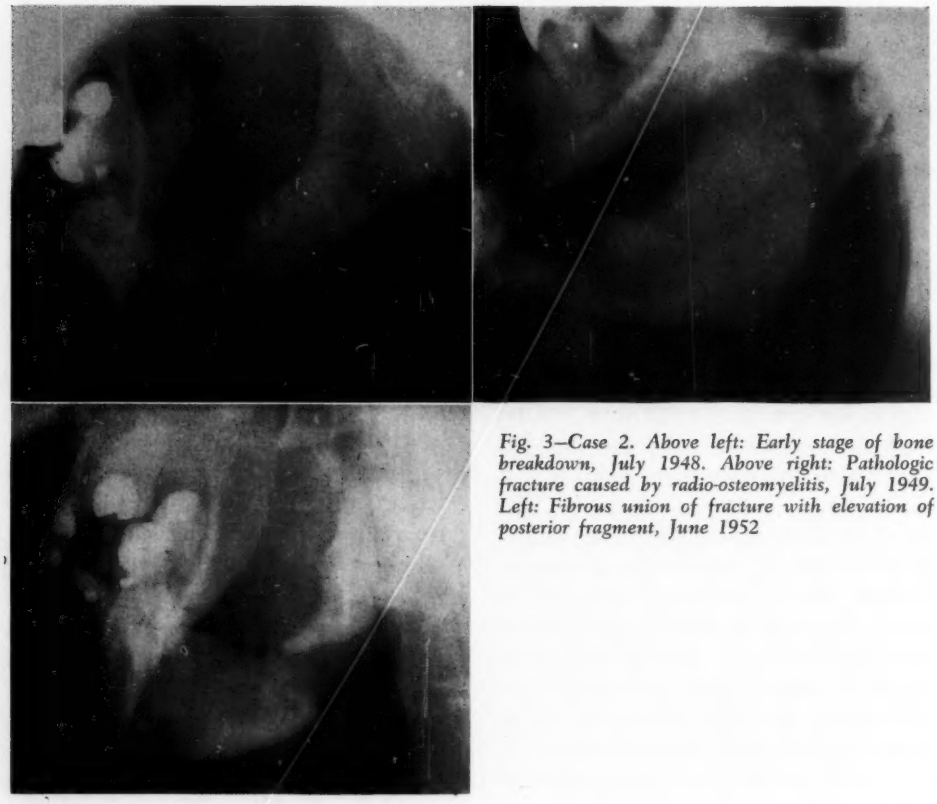


Fig. 3—Case 2. Above left: Early stage of bone breakdown, July 1948. Above right: Pathologic fracture caused by radio-osteomyelitis, July 1949. Left: Fibrous union of fracture with elevation of posterior fragment, June 1952

and analgesics prescribed for the pain.

Two months later a fresh bone exposure was seen lingual to the lower right first bicuspid. The patient complained of increased pain. Penicillin was prescribed for the acute local infection that was also present, and again analgesics were employed for pain.

In November 1948 the pain became severe and intractable, and an alcohol block of the right inferior alveolar nerve gave the patient relief. Roentgenograms revealed that the exposed bone still was not separated.

In February 1949 the sequestrum which had separated completely, as seen clinically and roentgenographically, was removed. There was still anesthesia of the inferior alveolar nerve.

In July 1949 the patient complained of difficulty in mastication. Roentgenograms showed a pathologic fracture through the lower right molar region (Fig. 3, above right). The right inferior alveolar nerve was still anesthetized. The distal fragment was riding upward with a large portion of it exposed orally. Because of extensive radio-osteomyelitis, no attempt

was made to reduce the fracture, and penicillin was prescribed to counteract the infection. In November 1949 it was necessary to remove loose sequestra from the line of fracture.

In March 1950 roentgenograms showed no union of the fragments. The exposed, sharp spine of the posterior fragment was removed with rongeur forceps. Soon after, an extraorally draining fistula developed and persisted. A month later there was a spontaneous intraoral discharge of pus. Pain now recurred and became persistent. Analgesics were ordered. Penicillin was discontinued and chlortetracycline was prescribed.

In June 1950 there still was no union of the fragments. Because there was no longer any sign of infection or malignancy, an operation for bone graft was considered. A week later an acute swelling of the face developed. Some hypertrophied tissue at the site of the original lesion was removed and examined microscopically. The report was negative for malignancy.

From August 1950 to November 1950 the patient was treated for loose sequestra and recurrent infectious flare-ups. In March 1951 a bone graft was again considered for nonunion; however, the patient refused. Instead he returned to his dentist and had a partial denture constructed to restore the missing lower teeth. He has worn this denture for over two years with good function and comfort, despite the fact that there is only fibrous union present. There have been no flare-ups since March 1951, and the tissues over the fibrous union appear normal (Fig 3, left).

■ *Summary and Conclusions*

1. Osteomyelitis of the jaws, superimposed on radionecrosis of bone, is a condition best described by the term "radio-osteomyelitis."

2. Infected and carious teeth and teeth in the line of irradiation should be removed prior to the administration of radiation therapy for malignancies of the jaws.

3. A postextraction healing period is advisable before radiation therapy is begun.

4. After irradiation every effort should be made to avoid trauma and infection of the irradiated parts. If extraction is unavoidable, extreme care must be employed, including full use of antibiotic therapy.

5. When radio-osteomyelitis occurs, conservative palliative treatment should be employed. Pain should be treated mainly with analgesics. In cases of intractable pain, nerve blocks with alcohol or prolonged-action local anesthetics may be performed. Frequent irrigations of exposed bone are in order, and sharp ends of exposed bone may be removed with rongeur forceps. Sequestra should not be removed until they are detached. Antibiotics should be used liberally to prevent spread of infection.—57 *West Fifty-seventh Street.*

Trichloroethylene with nitrous oxide-oxygen for inhalation anesthesia

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Dental practitioners of today should be familiar with the advances that have been made in inhalation analgesia and anesthesia for the ambulatory dental patient, since it is important in modern dental and oral surgical procedures. A knowledge of local anesthesia alone is not sufficient. A basic understanding of the principles and practice of general anesthesia is necessary in an adequate dental surgical practice.[1]

A recent improvement in inhalation anesthesia has been made through the use of trichloroethylene combined with nitrous oxide-oxygen. A few fundamentals of technic in administration of a general anesthetic for an ambulatory patient will be recapitulated.

The control of pain in oral surgery is important. There are specific indications for the use of trichloroethylene for analgesia, trichloroethylene with nitrous oxide and oxygen for anesthesia, and either one combined with local anesthesia for the control of painful stimuli and for the abolishing, or at least the minimizing, of anxiety regarding manipulations.

In the past, many dentists have limited themselves to the use of nitrous oxide alone or with oxygen, and the difficulty of obtaining smooth induction and maintaining an even plane of anesthesia is well known. The use of trichloroethylene is a relatively recent development. When it is used with nitrous oxide it is a valuable agent, since anesthesia is obtained with reduced excitement. In the past year in our private practice, we have used this type of anesthetic in over 2,000 patients of all ages. The nature of the surgical procedures varied from simple and complicated extractions to the reduction and immobilization of jaw fractures.

Trichloroethylene when used in combination with nitrous oxide is not the ideal general anesthetic;[2] however, it is the best that has been developed up to the present time. It has the following advantages:

1. Adequate oxygenation with avoidance of hypoxia, anoxia and asphyxia is possible.
2. Induction is quick, quiet and effortless.

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†Attending medical and dental staff, St. Francis Hospital, Blue Island, Ill.; attending staff, hospital oral surgery clinic, Research and Educational Hospitals, University of Illinois, Chicago.

1. Feldman, M. H. General anesthesia in dentistry. D. Survey 29:1624 Dec. 1953.

2. Axelrod, M. L. Increasing the value of nitrous oxide-oxygen with trichloroethylene for general anesthesia in dentistry. Lecture delivered before American Society for the Advancement of General Anesthesia in Dentistry, New York, 1950.

3. The analgesic and amnesic properties are high.

4. Excitement reactions are kept at a minimum.

5. The explosion hazard is minimized.

6. Bleeding or salivation is not increased.

7. There are few side reactions.

8. After-effects are minimal.

9. Recovery is rapid.

10. It can be used as an adjunct to local anesthesia.

11. The cost is low.

Other agents have been used in various combinations, in the hope of finding one that would permit adequate oxygen content,[3,4] as well as one that would offer other advantages over nitrous oxide. Ethyl chloride, ether, vinyl ether, ethylene, cyclopropane and thiopental sodium have been used, but each has been unsatisfactory in some way; for example, (1) ethyl chloride has an extremely rapid and uneven anesthetic course, and there is ever-present danger of laryngospasm; (2) ether has an undesirable odor, induction is slow, and recovery is delayed; (3) vinyl-ether causes increased salivation, has an unpleasant odor and rapid volatility, and may cause liver damage; (4) ethylene may cause vomiting, and there is the possibility of explosion; (5) cyclopropane has explosive qualities and may initiate development of cardiac arrhythmias; (6) thiopental sodium may cause laryngospasm and respiratory depression. The last named drug, thiopental sodium, is especially useful in oral surgery, but unless the surgeon is prepared to intubate the patient, it had better be used with caution.

The history, physical properties and pharmacology of trichloroethylene have been discussed in various articles;[5-8] it will be sufficient for present purposes to say that the anesthetic agent is colored with a blue dye and that in most instances it produces by inhalation a stage three, plane one, anesthesia.

■ *Technic of Administration*

CONDITIONING THE PATIENT—The emotional state of the patient should always be considered. The voice and general behavior of the dentist should be conducive to confidence and relaxation. A well-trained female assistant is of inestimable value in producing a relaxed state in the patient and the operator. The patient should be assured that the induction will be pleasant and the recovery rapid.

EQUIPMENT—All equipment should be in readiness—the anesthetic apparatus, mouth props, syringe filled with procaine or other anesthetic agent, and all instruments that will be used in the procedure. An efficient suction apparatus as well as good lighting are essential. Ordinarily the anesthesia machines used in dental offices differ from those used in hospitals in that they are calibrated in gallons of flow of

3. Willinger, Louis. Synergists supplementing nitrous oxide-oxygen. D. Items Interest 73:815 Aug. 1951.

4. Kornblau, A. H. Anoxia; its relationship to administration of anesthesia for the ambulatory patient. D. Items Interest 73:160 Feb. 1951.

5. Atterbury, R. A. Trichloroethylene in dental analgesia. Pamphlet 271. Madison, Wis., Ohio Chemical and Surgical Equipment Co., Jan. 1953.

6. Sadove, M. S.; Wyant, G. M., and Spence, J. M. Trichloroethylene in dentistry; general analgesia. J.A.D.A. 47:661 Dec. 1953.

7. Clement, F. W., and Seldin, H. M. Use of trichloroethylene and thiamylal sodium as adjuncts to other anesthetics in oral surgery. J. Oral Surg. 11:220 July 1953.

8. Sadove, M. S.; Wyant, G. M., and Spence, J. M. Trichloroethylene in dentistry; general anesthesia. J.A.D.A. 48:425 April 1954.

the mixture being used, whereas medical apparatus is calibrated in cubic centimeters. Physiological data on human beings usually is expressed in units of centimeters of tidal air, supplemental air, complemental air, and so on. It would be well if dental apparatus were calibrated to coincide with the units which are customarily used in human physiology so that what is happening between the body and the inhaled gases might be appreciated.

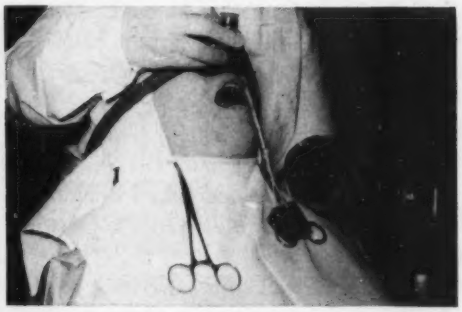
MOUTH PROP—A mouth prop is indispensable for most procedures.[9] It should occupy as little space as possible so as not to cramp the operative field or obstruct the air passage by forcing the soft parts of the floor of the mouth backward. A prop which can be inserted between the teeth without bending is preferable, and it is best to have several of these on hand. Two sizes of prop of different width are attached with a five inch stout cord. This makes an easily changeable unit for use in various sizes of mouths. If a surgical operation is to be performed on the opposite side of the mouth, another prop is available immediately. This second prop should be placed in its proper position before the first prop is removed. The prop may be placed after the patient has inhaled a breath or two of the inhalation agent, but before loss of consciousness prevents cooperation. Some men prefer to insert the prop prior to, or simultaneously with, the induction of anesthesia in order to make sure that the patient can breathe freely with it in place.

OROPHARYNGEAL PACK—The placement of an oropharyngeal pack in the posterior part of the oral cavity forms a wall or partition. This partition should be designed and placed properly, otherwise it may obstruct breathing instead of aiding it. The pack should be large enough to close off the throat without forcing the tongue back or unduly filling the oral cavity. It should serve the following purposes: (1) prevent foreign bodies from entering the larynx and pharynx; (2) prevent the swallowing of blood, mucus and pus; (3) prevent ingress of air; and (4) restrict the egress of gas, thus increasing gas concentration in the lungs.

There are several types of packs, the choice of which depends on the surgeon. When the pack is placed, the tongue is pulled forward with the tips of the thumb and index finger, and the pack is pushed slightly beyond the curve at the base of the tongue with a space between it and the posterior pharyngeal wall. Care should be exercised not to force the pack against the soft palate in a way that will interfere with nasal breathing.

PREOPERATIVE PRECAUTIONS AND PREMEDICATION—The patient should not eat for several hours before the procedure. If possible, the appointments should be made for the morning. A routine precaution to empty the bladder is recommended to the patient. Premedication (1½ grain secobarbital sodium or other barbiturate, or chloral hydrate) may be used a half hour before the procedure. For short procedures, particularly in children, all premedication may be omitted; in certain instances it may be contraindicated.

9. Atterbury, R. A. Operating room technic for oral surgical treatment. J.A.D.A. 35:706 Nov. 15, 1947.



Above left: Patient suitably draped; head in correct position for maintenance of airway. Above right: Position of mouth prop and nosepiece. Left: Support of nose and mouth pieces

Sometimes 1/150 grain of atropine can be used under the tongue to produce a dryer operative field. It is safer to omit heavy premedication.

ADMINISTRATION — The following technic for administration of the drug is suggested:

1. After a brief medical history has been taken and adequate roentgenograms made, a clinical examination is carried out. Then the chair is inclined slightly, the patient is suitably draped, and the operative field is prepared (illustration, above left).

2. A mouth prop is placed in position near the operative field, and the nose piece is placed and adjusted (illustration, above right).

3. The amount of trichloroethylene and nitrous oxide-oxygen needed varies with the patient and with the extent of the procedure. If as much as 20 per cent oxygen is used, the patient will be protected from hypoxia.

4. Belts and restraints seldom are used except with robust and muscular individuals or with known alcoholics or drug addicts. This does not mean, however, that adequate protection should not be given in any case where it seems to be indicated.

5. The anesthetic mixture is started, and the patient is reassured. The fewer instructions given the patient concerning inhalation, the better. The administration of the nitrous oxide-oxygen mixture may precede by a few breaths the administration of the trichloroethylene. This latter agent is given slowly but progressively:

the collar of the vaporizer is advanced from the minimum position toward the halfway mark at a rate of approximately a notch for each three respirations. For most of the patients, about 25 inhalations are sufficient. The speed and smoothness of the anesthesia obtained when trichloroethylene is used in this manner is gratifying.

6. An air valve for exhalation is left open to permit escape of carbon dioxide. The rebreathing connection of the anesthetic apparatus is used to conserve the agents used. Trichloroethylene should never be used in a closed system with soda lime because of the poisonous substances formed by the interaction of the lime and the anesthetic agent.[10]

7. Inhalations and exhalations are noted carefully. Most patients enter and remain in the first plane of the third stage of surgical anesthesia with little excitement. The time required for reaching this stage should not be the criterion for administration of the anesthetic, but rather the stage in which the patient has arrived. Usually the symptoms of anesthesia become evident within about one to three minutes. Loss of the wink reflex, fixation of the eyeballs, regular respiratory excursion and a relaxation of the skeletal musculature are good signs of an adequate degree of anesthesia. The patient's mandible should be supported at all times, and the operator should bear in mind the anatomic location of the carotid sinus and artery, since undue pressure over this area will create an immediate undesirable reaction on the part of the anesthetized patient (illustration, below).

8. Local anesthesia may now be administered at the discretion of the operator. What appears to be a first plane of stage three may not be sufficient anesthesia for the relatively heavy forces that are applied in extraction, and a local anesthetic administered early will aid in keeping the patient from becoming too greatly stimulated. The alternative is to continue the general anesthetic agent, but a local anesthetic may be used as a supplement to lessen the time of anesthesia and to prevent postoperative pain. Sometimes it becomes desirable to discontinue a procedure under general anesthesia, and then the use of a local anesthetic permits many operations to be completed which otherwise might have to be deferred. No fatalities have been reported through the simultaneous use of trichloroethylene and local anesthetics with epinephrine,[11] but there is the possibility of the development of cardiac arrhythmias, including ventricular fibrillation; therefore, it is just as well to avoid the use of epinephrine in the local anesthetic.

9. At the conclusion of the oral procedures, the anesthetic is discontinued. The patient usually responds with an uneventful and rapid recovery. After the anesthetic is discontinued, the superficial tissues appear insensible to pain for several minutes; this allows time for minor trimming of bone, suturing and contouring. The patient usually recovers within about ten minutes.

■ *Conclusions*

Experience with over 2,000 patients in our private practice demonstrates that

10. Firth, J. B., and Stuckey, R. E. Decomposition of tr.lene in closed circuit anesthesia. Lancet 1:814 June 30, 1945.

11. Ostlere, Gordon. Trichloroethylene anesthesia. Edinburgh, E. & S. Livingstone, Ltd., 1953.

trichloroethylene is a valuable agent in combination with nitrous oxide and oxygen. It comes close to meeting the requirements of an ideal agent for the inducement of analgesia or anesthesia in the ambulatory patient. The inclusion of trichloroethylene considerably widened the range of procedures in which nitrous oxide and oxygen may be used.

Trichloroethylene would appear to be of practical value in that it minimizes the unpleasant associations connected with operative dentistry and oral surgical procedures. The ease of manipulation, the lack of an explosion hazard, the minimum of after-effects, increased amnesia, rapid recovery of the patient and the fact that it can be used as an adjunct to a local anesthetic recommend this drug for use in dentistry.

A careful evaluation of the physical and mental state of the patient and a recognition of the operative limitations in anesthesia for the ambulatory patient are at least as important as the agents and technics used.—*1011 Lake Street.*

Rectal thiopental sodium anesthesia for the ambulatory child dental patient

■ *Stanley J. Behrman,* D.D.S.; Howard I. Mark,† D.M.D., and Alfred A. Brown,‡ D.D.S., New York*

The fears and phobias, anxieties and resentments which many patients bring with them to the dental office frequently are related to the psychic trauma of an operation that had been performed during childhood. This operative procedure may have been dental, surgical or manipulative in another manner; the consequent emotional disturbance may have been evident immediately or may have remained latent for many years. The essential point is that undesirable disturbing factors should have been kept to a minimum. Rectal administration of thiopental sodium (Pentothal) provides a safe means of minimizing the disturbing effects of manipulative procedures on young children in the dental office.

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Because it is generally believed that neuroses and other psychiatric disorders have their origin in childhood,[1] psychiatrists have been greatly concerned over the emotional disturbances induced by operations on children.[2] That they have not as yet singled out dental operations is not because the dental procedures or methods are any less upsetting than the others. Certainly the dental office appears no more like home to a five year old child than does a room in a hospital. A general anesthetic administered for a tooth extraction is no pleasanter than a general anesthetic administered for a tonsillectomy. Nor are the dentist's gown, the chair, the lights, the unit, the entire dental armamentarium less terrifying than their equivalent in the hospital operating room. When the fact is added that all dental procedures are performed within the oral cavity, a region that is rife with psychological implications, it becomes obvious that the impressionable juvenile mind must be protected as much as possible from the psychic trauma of dental manipulation.

Children coming to the office have two fundamental fears—fear of separation from their parents and fear of injury. Much of a child's security is derived from the presence of his parents and from familiar comforting surroundings. The value of a homelike reception room has been emphasized before.[3] What has not been stressed sufficiently is the critical nature of the separation of the child from his parents. This deprives him of his security and thus intensifies the fear of being injured. Today, beginning in infancy, every child receives inoculations and injections. It is common for children to be temporarily or even permanently conditioned against any doctor because of this early subjection to needle puncture.[1] In fact, many children begin to cry at the sight of a white coat. This early exposure to pain and the establishment of unpleasant associations make it even more imperative that dental procedures neither threaten the child's security nor subject him to pain.

This paper will not discuss the pros and cons of anesthesia for various dental procedures but will be confined to instances in which anesthesia is mandatory; specifically, the extraction of teeth and other surgical procedures. Because a surgical procedure is different from any other dental manipulation to which he may have become accustomed, it reactivates the child's fear of injury. In addition, there is added the psychological association between the extraction of a tooth and the fear of mutilation.[4] These factors make a general anesthetic preferable to a local anesthetic, provided that the administration of anesthesia is not in itself a cause of trauma.

Unfortunately, the agents and technics in use today for anesthetizing the ambulatory child dental patient are injurious psychologically. These agents are inhalants which have an unpleasant smell or require the use of a mask, or both. Every child is frightened by having a mask put over his face no matter how

1. Huschka, D. M., and Ogden, O. S. The conduct of pediatric prophylaxis clinic. J. Pediat. 12:794 June 1938.

2. Levy, D. M. Psychic trauma of operations in childhood and note on combat neurosis. Am. J. Dis. Child. 69:7 Jan. 1945.

3. MacGregor, S. A. Practical suggestions on child management. New Zealand D. J. 48:102 April 1952.

4. Jackson, E. B. Treatment of young child in hospital. Am. J. Orthophyschiat. 12:56 Jan. 1942.

many times it is called "an elephant's trunk." This fear of suffocation is intensified when a child is forced to breathe irritating ethyl ether, vinyl ether, trichloroethylene or ethyl chloride. The fact that the child does not cry does not indicate that he is unconcerned and not afraid; silence often indicates overwhelming fear.[4] Levy[2] writes of a child referred to him at five years, nine months of age in whom fear of the dark developed as well as increased frequency of bed wetting after a ten minute procedure under general anesthesia in a physician's office. An operation carried out in a dentist's office could easily have had the same effect.

A method of general anesthesia for ambulatory children will be presented which eliminates the psychic trauma produced by the other technics. There are no odors and there are no masks. A natural dream-free sleep is induced. The parent is permitted to be with the child during every moment of consciousness, and thus the child's fear of separation is eliminated. It utilizes a simple manipulative technic with which almost every child is familiar. At the dental clinic of The New York Hospital and in the private practice of the senior author, this procedure is routine for children between the ages of 2 and 10 who require dental or minor oral surgery. The method involves the administration of thiopental sodium by the rectal route.

■ *History of Rectal Anesthesia*

Rectal anesthesia is the rectal administration of an anesthetic drug to obtain amnesia or anesthesia.[5] The narcosis so obtained approximates the second stage of anesthesia, or that stage in which a state of unconsciousness with relative insensibility to pain is produced.

The induction of anesthesia through rectal administration is a procedure which dates back over 100 years to Roux, who in 1847 used an ether-water mixture. Magendie in that same year substituted ether vapor as his rectal agent of choice.[6] In 1864 Piergaff proved that ether was readily absorbed in the rectum.[5] Gwathmey[6] in 1913 used an olive oil-ether mixture. In 1926 Duisberg found tribromoethanol (Avertin) to be effective and hexobarbital sodium was introduced by Gwathmey in 1936.[6]

For various reasons none of these early agents was satisfactory. Until the introduction of rectal administration of thiopental sodium by Weinstein in 1939,[7] there were many drawbacks to the use of that type of induction. Among these drawbacks were lengthy recovery periods that meant constant observation and care, respiratory depressions and ensuing embarrassments, and muscular spasms. With the advent of rectal administration of thiopental sodium, these barriers were largely overcome. Recently other barbiturate solutions have been utilized, but thus far only preliminary reports have been published.[8]

■ *Thiopental Sodium by Rectum*

In the method to be described herein, rectal thiopental sodium was used as a

5. Collins, V. J. Principles and practices of anesthesiology. Philadelphia, Lea & Febiger, 1952, ch. 19.

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7. Weinstein, M. L. Rectal pentothal sodium: a new pre- and basal anesthetic drug in the practice of surgery. Anesth. & Analg. 18:221 July-Aug. 1939.

8. Poe, M. F., and Karp, M. Seconal as basal anesthetic agent in children: a preliminary report. Anesth. & Analg. 26: 152 July-Aug. 1946.

basal anesthetic agent. Basal anesthesia is that degree of anesthesia which allows the patient to reach the unconscious state, be relatively insensible to pain, yet does not depress to the degree needed for major surgery. Weinstein[9] reported on 2,500 cases in which rectal thiopental sodium was used to provide basal anesthesia for various procedures. Hooper,[10] Burnap,[11] Carron,[12] Artusio and Trousdell,[13] and others[14-16] have reported the use of rectal thiopental sodium as a basal anesthetic agent for children. Up to the present, however, no one has reported on the use of this agent or technic for dental procedures on ambulatory patients.

Although anesthetic induction by rectum has been used for adults and children alike, it has become restricted to a great extent to pediatric manipulative procedures. In children the desired effect is obtainable with much smaller amounts of the agent than would be necessary for the adult. Intravenous administration is simpler and generally is accepted readily by adults and by children older than the 2 to 10 year old group in whom venipuncture is difficult anatomically and psychologically. Yet this same 2 to 10 year age group is familiar with rectal instillations.

In certain respects the slower absorption rate when thiopental sodium is administered rectally makes it safer than when it is administered intravenously. There is no injury to the skin, muscles or veins. In the suggested concentration there is no irritation or inflammation of the rectal mucosa. The solution is noninflammable and nonexplosive, consequently there is no danger from the use of electrocautery or other electrical equipment during its administration. Another advantage is that, other than perhaps assisting in the maintenance of a clear airway, the anesthetist or anesthesiologist may be well away from the operative field during the surgical manipulation.

■ *Action of Rectal Thiopental Sodium*

During rectal induction, the respiratory rate is not appreciably altered nor is the blood pressure particularly affected. The pulse rate is maintained at near physiologic levels,[17,18] which is a contrast to the tachycardia so common in children under inhalation anesthesia.[19] Marbury[20] showed that when thiopental sodium was administered rectally there was no significant change in oxyhemoglobin saturation of the blood. The excitement stage is eliminated and laryngeal stridor is uncommon. Nausea and vomiting are at a minimum.

It is believed that the action of thiopental sodium is in the cerebral cortex and probably also in the subcortical ganglia,

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12. Carron, H. Discussion. South M. J. 42:914, 1949.

13. Artusio, J. F., Jr., and Trousdell, M. Comparative study of rectal pentothal and morphine for basal anesthesia upon children for tonsillectomy. Anesthesiology 11:443 July 1950.

14. Schotz, S. Rectal pentothal for basal narcosis in infants; report of three cases. Anesth. & Analg. 21:295 Sept.-Oct. 1942.

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17. Mark, L. C.; Fox, J. L., and Burstein, C. L. Preanesthetic hypnosis with rectal pentothal in children. Anesthesiology 10:401 July 1949.

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19. Jackson, K. Tachycardia in children during anesthesia. Anesthesiology 9:573 Nov. 1948.

20. Marbury, B. E. Study of blood-oxygen saturation in children under rectal pentothal anesthesia. Anesthesiology 11: 589 Sept. 1950.

especially the hypothalamic portion of the diencephalon. It thus appears that the main action is depression of the cells in the brain stem and basal ganglia. This action accounts for the amnesic effect and lack of disagreeable postoperative memories. It explains why there is rarely a recollection of any phase of the operative procedure other than is indicated by the answer "my temperature was taken and then I fell asleep"—the answer that is given by most of the patients on being questioned.

■ *Aim of the Study*

The aim in the study to be described was to develop a method of anesthesia that would eliminate the crying, struggling and screaming of the child who is terrified by the usual general anesthetic procedure. With inhalation anesthesia, the child is taken into a room full of strange equipment, separated from his mother, perhaps wrapped tightly in a sheet or blanket, has a mask put over his face and is forced to breathe an irritating vapor. In contrast with this, when rectal thiopental sodium is used, the child is taken into a room by his mother, is accompanied by a favorite toy, does not see the doctor but has a nurse "take his temperature," and then gently falls into a dreamless sleep.

The safety and efficacy of rectal thiopental sodium as a basal anesthetic has been well established by many investigators. These reports, however, were based on hospitalized patients. The problem was to modify established technics so as to make them adaptable for use with the ambulatory patient in a suitably equipped dental office staffed with properly trained personnel. Determination of the stage at which the patient could be taken home safely was a prime objective. It was also important that the surgeon's time be kept as productive as possible; that he be with the patient only long enough to perform the surgery and insure the child's safety. It was also desirable that the recovery period be as short as is commensurate with safety so as to keep personnel available for other patients. Most essential was that everything be developed to insure that there would be minimal psychic trauma experienced by the child.

This study was based on a series of 88 children, either clinic or private patients, who were treated between August 1952 and March 1954. All observations were recorded by two men so that there was a minimum of variation in the evaluations. The children ranged in age from 1½ to 9 years, with the average age being 4 years, 9 months. The average child weighed 18 4/10 Kg. (39 pounds) with the lightest weighing 11 Kg. (24 pounds) and the heaviest 32 7/10 Kg. (71 pounds). There were 46 girls (52 per cent of the group) and 42 boys (48 per cent).

The average time of actual operation was 5 8/10 minutes, with the shortest procedure lasting 1 minute and the longest 17 minutes. The surgical procedure generally consisted of the extraction of teeth, although one frenectomy was performed and one child had many sharp hypoplastic cusps ground off his teeth. The average number of teeth removed was three; eleven were the most removed at any one time. Five of the children were repeated in the series, from 1 to 6½ months elapsing between their first and second administrations.

■ *Selection of Patients*

All children up to the age of ten years who required dental or minor oral surgery were included in this series, provided that there were no organic contraindications. Children older than ten years of age usually exhibit minimal psychic reactions to operative procedures of this type, can logically understand the use of local anesthesia and are large enough to permit easy venipuncture.

Every patient was given a physical examination by a pediatrician within 48 hours prior to the operation. Clinic patients were examined in the pediatric clinic on the morning of the operation. Private patients were examined by their own pediatricians who were requested to send a note indicating whether the child was suited for the proposed general anesthetic. A urinalysis and hemoglobin determination were obtained routinely at the hospital. In routine use outside the hospital, the pediatrician's physical examination should be sufficient.

There are extremely few patients encountered with whom rectal thiopental sodium should not be used. There are several contraindications to its use, however; for example (1) severe involvement of the trachea or mediastinum, edema of the glottis, or any other condition that would be likely to embarrass respiration; (2) severe cardiac impairment with decompensation; (3) severe anemias; (4) rectal inflammatory diseases or loss of control of the anal sphincters. Also, some authors believe liver or kidney disease to be a contraindication.[11, 13]

In our series the drug was administered safely to children with acyanotic congenital heart disease, Cooley's anemia, sickle cell anemia, grand mal epilepsy, petit mal epilepsy and cerebral palsy.

■ *Preparation of the Parent and Patient*

It is important that the parents be instructed carefully in the psychological and physical preparation of the patient. Above all, the parents must be honest. The child is quick to sense deception and trickery. This will establish not only a relationship of mistrust and insecurity but it may lead the child to interpret the ensuing procedure as one of punishment. The child should be told that he is going to have a tooth removed; that the procedure will be pleasant and comfortable and that his mother will be there at all times. It should be explained that the nurse will take his temperature; that he will get sleepy while she is doing this, and that while he is fast asleep his tooth will be extracted.

The child must have nothing to eat or drink after midnight preceding the anesthesia. An effective tap-water enema is given before going to bed; this is repeated in the morning. Tap water is preferred to soap-suds as these may be irritating and may interfere with the absorption of the thiopental sodium solution. The child is taken to the lavatory prior to anesthesia. If he has not previously been weighed, it is done at this time.

Atropine sulfate is given as a premedicant. It decreases the secretions throughout the upper respiratory tract, especially at the site of the operative procedure and thereby lessens the possibilities of aspiration and laryngeal irritation. The required dose in children is relatively

small. We routinely give .0002 Gm. (1/300 grain).

Ideally, the atropine is given subcutaneously at the time of the urinalysis and hemoglobin determination. The child is apt to associate it with these tests rather than with the administration of the anesthetic. If not administered at that time, it is given intravenously after the child is asleep. No injection is ever given at or near the room where the anesthetic is to be administered or by personnel the child will see at the time of anesthesia. Early in the series under discussion atropine was given by mouth, but this was discontinued because of the possibility of vomiting the water used as a vehicle.

■ *Armamentarium*

There are certain fundamental pieces of equipment that should be in every room in which any general anesthetic is administered, no matter how brief the period of anesthesia: (1) a resuscitator, capable of delivering oxygen under pressure; (2) a suction machine and catheters; (3) a laryngoscope and endotracheal tubes, and (4) emergency drugs, syringes, needles and a tourniquet.

For the rectal administration of thiopental sodium, this equipment is supplemented with (1) a fresh 10 per cent solution of rectal thiopental sodium in 20 cc. syringes; (2) a soft rubber catheter connected to the syringe; (3) a clamp (hemostat) with rubber covered ends (Fig. 1); (4) petroleum jelly, and (5) supplementary inhalants, ethyl and vinyl ethers, and an open-drop mask. Both the administration of the anesthetic and the surgery are performed with the child on a table or cart. Some arrangement must be available whereby the head may be lowered. Restraining devices are never necessary. Syringes and catheters are sterilized after use.

■ *Preparation of Solution and Dosage*

A 10 per cent solution of thiopental sodium is used. This is an effective solution and one which lends itself to easy calculation and administration of dosage. The thiopental sodium powder is dissolved in lukewarm tap water of a proper volume to provide a solution in which each cubic centimeter will contain 100 mg. of thiopental sodium. For example, the contents of a 3 Gm. ampule are dissolved in 30 cc. of water, thus giving the desired 10 per cent solution. For rectal administration only, thiopental sodium is supplied in nonsterile vials containing 3.0 Gm. of powder. This contains an added dye which gives a clear bright green color

Fig. 1—Armamentarium consisting of 20 cc. syringe, soft rubber catheter and clamp (hemostat) with rubber covered ends

Fig. 2—Induction of rectal thiopental sodium anesthesia

when the powder is dissolved in water. The standard sterile ampules of thiopental sodium for intravenous use also may be used to prepare a rectal solution. When dissolved in water, these give a faint yellow-green color. Solutions made from the sterile powder may be kept for several days, but those from the nonsterile vials should be prepared fresh each day.

Body weight is the best indication for dosage and is extremely reliable in all uses of rectal thiopental sodium. For basal anesthesia, dosage is calculated on the basis of 1 Gm. of thiopental sodium to each 25 Kg. (55 pounds) of body weight. When a 10 per cent solution is used, it means that 0.4 cc. of solution are administered for each Kg. (2.2 pounds) of body weight: $W \times 0.4 =$ dose in cc. (W = weight in Kg.). For example, a child weighing 20 Kg. (44.0 pounds) would receive a dose of 8 cc.

■ *Rectal Administration of Thiopental Sodium*

After the results of the physical and laboratory examination have been evaluated, the child and parent are taken to the quiet, dimly-lit operating room. The child may be undressed and a gown put on him, or his clothes merely adjusted to expose the buttocks fully. He is then placed on his side on the table and told that he is to have his temperature taken. A catheter, well lubricated with petroleum jelly (French catheter, size 12 to 18) is inserted about three inches into the rectum. Attached to the catheter is a 20 cc. syringe containing the precalculated dose of thiopental sodium (Fig. 2). This is instilled slowly and the catheter is cleared with air to insure that the total dose has been given. To prevent expulsion of the solution, the buttocks may have to be held together by the anesthetist. The catheter is then clamped off and is kept in place so that any unabsorbed solution may be withdrawn when the child is asleep. The parent in the room is encouraged to talk soothingly and reassuringly to the patient. The room should be as quiet as possible with activity kept to a minimum; it must be remembered that the sense of hearing is the last to disappear under anesthesia.

■ *Onset of Anesthesia*

Within two to five minutes after administration the child will become drowsy and fall into a natural sleep. About this time the parent is asked to leave the room quietly. The child is kept on his side with his head and chin extended. The anesthetist should stand at the patient's head. About ten minutes after instillation of the thiopental sodium the child is usually well asleep and the surgeon is notified.

The surgeon and his assistant come into the room and the patient is draped. By now 15 minutes have elapsed since the

instillation of the thiopental sodium. Ideally now the pupils will be central and fixed, the eyelid reflex will be gone, and the corneal and light reflexes will be intact. The child should respond to supraorbital pressure or pressure on the ear or the ear cartilage by slight movement of the head or one of the extremities. Such movement is momentary, and may also occur as the mouth prop is gently and slowly inserted.

A local anesthetic containing a vasoconstrictor is then infiltrated about the operative site. This serves several purposes. First, stimulative impulses from the operative site are prevented from reaching the brain. This lessens the general anesthetic requirements and enables the patient to be quiet and relaxed on a smaller dose of the agent. Secondly, bleeding at the operative site is lessened, thus a clear field is provided, the need for suction is lessened and the opportunity for blood to reach the pharynx is minimized. Thirdly, the patient will feel no pain on awakening nor until the local anesthetic wears off. If a long-acting local anesthetic is used (we use 2 per cent lidocaine hydrochloride) the patient will be home playing with his friends before he may feel any discomfort. In this way he will be less inclined to associate pain directly with the dental office, personnel and procedures. In fact, by the time there is any discomfort his other distractions will be such that he probably will not even be aware of it.

The administration of the local anesthetic may cause slight discomfort and movement of an extremity, but this is momentary as long as the injection is given slowly and gently. Infiltration anesthesia is effective about the mandibular teeth in this age group because the bone is considerably more vascular and porous than it is in later years. Within a few moments there is sufficient anesthesia to permit the surgery to begin. At this time the anesthetist withdraws any unabsorbed thiopental sodium that remains in the rectum and removes the catheter.

In a small percentage of cases the stage of basal anesthesia may not be obtained. This may be because the precalculated dose was too small for a particularly hypertonic child, or perhaps the preparatory enema was not an effective one and there is less absorption of the thiopental sodium. The child will probably be in a lighter amnesic stage and supplementary vinyl ether or ethyl ether may be administered by the open drop method. Vinyl ether (Vinethene) is preferable because of its rapid acting time and short duration. Nitrous oxide with oxygen and ethylene are compatible with thiopental sodium and may be used as supplements. There may be some stimulation to involuntary movement because these vapors are irritating, but this is very brief. The important fact is that the child will have absolutely no recollection of this phase of the procedure because of the amnesia that invariably is produced by the thiopental sodium.

The use of a gauze throat pack is not routine since there is no need to pack off the oral cavity to prevent the escape of gases as there is when a nasal inhalant is administered. On the average, three teeth may be extracted at a time, and the little bleeding that occurs can be suctioned easily by the assistant. For added protection a sponge is held in the surgeon's free

hand and is kept behind the operative site. Oxidized cellulose (Gelfoam) is placed in each extraction wound, and then pressure with the gauze sponge is applied immediately. The surgeon should not leave the patient until all bleeding has stopped.

■ *Overdosage*

Overdosage was nonexistent in our series and its occurrence is reported rarely in the literature. Overdosage results in excessive respiratory depression. The treatment of choice is the administration of 100 per cent oxygen with a resuscitator, if necessary. For medico-legal reasons it is best to have some analeptic drugs on hand, but we do not recommend their use.

■ *Recovery*

When the child is recovering, the table is placed in slight Trendelenberg position, and oxygen may be administered. As soon as the child reacts, the parent should be called into the room and should speak to the child in a quiet gentle manner. As he awakens he may be given his favorite toy which has been brought along. The patient is then dressed and taken home. Occasionally a child may vomit slightly (this occurred in 2 per cent of our series), and a small percentage may evacuate the rectum (2 per cent of our series). The parents are given the customary postoperative instructions. They are asked to note carefully the child's reaction to the events of the day and the appearance of any unusual behavior such as nightmares or bed wetting. Approximately 95 per cent of the parents or children were interviewed within several days after the operation.

■ *Results*

It was the purpose of this study to develop a method of anesthesia which was psychologically atraumatic. If successful, the results should show: (1) satisfactory anesthesia was obtained; (2) it was safe for the child to be ambulatory; (3) the procedure was psychically atraumatic.

QUALITY OF ANESTHESIA OBTAINED—The quality of the anesthesia was evaluated largely from the surgeon's point of view: Was the patient relaxed, was there minimal amount of response to stimuli, were any respiratory or other difficulties encountered?

On this basis, an "excellent" rating was given to 72 of the 88 cases or 82 per cent. This rating meant that the child was completely relaxed and cooperative and there was a minimal amount of movement from the stimulation of the insertion of the mouth prop or injection of the local anesthetic. No supplementary agent other than the routine local anesthetic was used in these cases.

Ten of the children, or 11 per cent, evidenced more than minimal movement in response to stimuli, and they may have cried a little during the procedure. These cases were rated as "good." Some of these patients required supplementary inhalants if more than one tooth was removed.

Six of the cases, or 7 per cent, were rated as "fair." In these instances the children did not reach the plane of basal anesthesia. The preanesthetic hypnosis obtained in four of the cases was inadequate to insure complete cooperation, and supplementary inhalants were used. In

one instance the hypnosis was excellent, and the child was most cooperative so that the tooth was removed with the aid of the routine local anesthetic. Nevertheless, this case was given only a "fair" rating because the anesthetic stage was not reached. The remaining case classified as "fair" was a one and a half year old child who had many sharply pointed hypoplastic cusps ground off his teeth. Neither local nor inhalant supplementary agents were used, and the low rating was given because the child cried during the entire ten minute procedure.

Of the 16 rated as "good" or "fair," nine required supplementary inhalants; that is, 10 per cent of all 88 cases. In 90 per cent of the cases, then, the anesthetist was well away from the operative field. In 100 per cent of the cases there was amnesia beyond the induction stage. These observations indicate that rectal administration of thiopental sodium provides satisfactory anesthesia.

WAS IT SAFE FOR THE CHILD TO BE AMBULATORY?—In no instance was respiratory difficulty, either obstruction or depression, encountered during induction, maintenance or recovery periods. The time from the completion of surgery until the child regained all of his reflexes was designated "reaction time." The average reaction time was 15 minutes. The time from the regaining of all reflexes until the child was oriented, responded to the spoken word and could walk with little assistance was designated "recovery time." The average recovery time was 34 minutes.

The reaction and recovery periods were smooth and uneventful. Two children vomited a little while getting dressed. Two children defecated during this period. Trained personnel attended the child until he reacted, after which time the parent attended him alone. Because this was a new procedure, all the patients were kept under observation until they were fully recovered. There does not seem to be any real need for this, and there is no reason why a child cannot leave soon after he has reacted if his parents can carry him. It should be pointed out that the administration of supplementary inhalants slightly prolongs the recovery period. For that reason short-acting vinyl ether is preferred. The absence of respiratory depression and the rapid return of vital reflexes make rectal thiopental sodium anesthesia a safe procedure with ambulatory patients.

WAS THE PROCEDURE PSYCHICALLY ATRAUMATIC?—In order to evaluate properly the psychic value of this form of anesthesia, the parents were urged either to bring the child back for an evaluation visit or to call so that they could be questioned about the events and remembrances that the child may have mentioned. Some report was obtained in approximately 95 per cent of the cases.

The majority of the children slept for one to two hours after arriving home. They then resumed their normal play habits without apparent discomfort or ill effects. The others needed no additional sleep on leaving the clinic and resumed their normal activities almost immediately.

The parents and the children were asked some leading questions about the anesthetic procedure. Here are some of the typical questions and answers:

1. Q. What do you remember about your visit here?

A. I got another enema, and then I fell asleep.

A. The nurse took my temperature, and I got sleepy.

A. I lay down on a table, and the nurse gave me another enema.

2. Q. Do you remember having your tooth taken out?

A. "No" was the universal reply.

3. Q. What did you do when you got home?

A. I fell asleep, and played with my toys when I got up.

A. I played with my toys.

A. I had some soup and some ice cream, and played with my toys.

A. I fell asleep.

4. Q. Did you have any bad dreams?

A. "No" was the universal reply.

5. Did you eat a good supper?

A. "Yes" was the answer in most instances.

A. "I had some soup and some milk" was the usual other reply.

6. Q. Did you have to go to the bathroom during the night?

A. "No" was the universal reply.

7. Q. Did your teeth bother you when you got home?

A. No.

A. Just a little.

8. Q. Did your child have any nausea or vomiting at home?

A. "No" was the universal reply.

9. Q. Did your child talk about the extraction of his tooth?

A. Only to say that he had a tooth gone, and to be sure to put it under his pillow.

10. Q. Did your child cry out during the night?

A. "No" was the universal reply.

All the parents interviewed were extremely pleased with the procedure. They were particularly pleased because their children were not unduly alarmed or excited and because the recovery from the procedure was uneventful.

One child in the series had had rectal thiopental sodium anesthesia about a year previously for eye surgery, and she was extremely happy and very cooperative when she learned that she was to have the same anesthesia again. In fact, when extraction of the tooth was discussed, she asked the doctor if she could be put to sleep the same way as before.

One child who appeared in the series twice had had inhalation induction for a tonsillectomy during the six month period between our administrations of rectal thiopental sodium. His mother was impressed by the difference in the postanesthetic behavior after the two methods of induction of anesthesia. She felt that the inhalation procedure had reactivated fears which we had succeeded in eliminating. She had to travel a considerable distance to bring the child for the second rectal thiopental sodium administration, and this necessitated spending the night in a hotel. Her child's postanesthetic behavior convinced her that it was worth the effort.

Observation of the difference between the pleasant, smooth, natural sleep induced by thiopental sodium and the exciting, suffocating fearful induction of the inhalants makes it obvious that it must be less traumatic to the child's psyche. The postanesthetic interviews bear this out.

■ *Disadvantages of Rectal Thiopental Sodium Anesthesia*

There are certain aspects of this procedure which may be classified as disad-

vantages. An example of these is the need for the cleansing tap-water enemas in the evening and morning preceding the anesthesia. Weinstein and Light[6] do not feel that enemas are a necessary preanesthetic preparation. We found no positive correlation between the induction time or the quality of anesthesia and the presence or absence of preparatory enemas. The number of children with whom enemas were not used was not sufficient to evaluate whether there would be an increase in the percentage of defecations. This aspect might be worth further investigation. None of the parents objected to giving the enemas, however, and they apparently are a fairly commonplace occurrence to the average child.

Another disadvantage might be the seemingly long reaction and recovery times. It is known that most children recover in about 30 minutes after an inhalation procedure; this is about the same period of time as is required after rectal thiopental sodium administration. The smooth, easy recovery period, however, would more than make up for any increase in recovery time.

A table or cart is necessary and these are not found in the average dental office. This procedure is not indicated for the average dental office, however, but for one that is suitably equipped and one staffed with properly trained personnel.

■ *Advantages of Rectal Thiopental Sodium Anesthesia*

The advantages of rectal thiopental sodium anesthesia more than make up for any of the disadvantages. It provides smooth, safe, effective anesthesia with a minimum of psychic trauma. It is easily administered with a minimum of equipment. The drug is odorless, noninflammatory and nonexplosive. It is readily administered and readily accepted by the child.

■ *Summary*

Many of the fears and anxieties which patients bring with them to the dental office may be related to the psychic trauma of an operation that had been performed in childhood. The usual dental anesthetic methods used with children are fraught with psychic trauma.

A method for the use of thiopental sodium by the rectal route for ambulatory children has been evolved.

Rectal thiopental sodium anesthesia has been found safe and effective in a series of 88 children 1½ to 9 years of age, and it produced a minimum of psychic trauma.

Rectal administration of thiopental sodium is now routine practice at the dental clinic of The New York Hospital and in the private practice of the senior author.

Intravenous anesthesia in office practice

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The problems to be solved in the use of intravenous anesthesia in office practice are essentially the same as those for all general anesthesia in hospital practice. As stated in Guedel's[1] classic definition, these problems are "to deliver the anesthetic agent into the brain in a concentration indicated by the operation to be performed, to hold it there in controlled concentration as long as it is needed and to get it out again—all with the least possible interference with the normal physiological processes of the body."

Three important differences exist between the office practice of oral surgery and general hospital practice which profoundly affect the management of the anesthesia. The first is that most dental procedures are of relatively short duration and require only the lightest planes of anesthesia. The second is that the operative field is always in the airway and thus the danger of anoxia, either by mechanical obstruction or by reflex action, is continually present. The third is that oral surgery patients are ambulatory and must be able to walk out of the office within a reasonable length of time.

Because the problems of inhalation anesthesia in oral surgery are so great as frequently to defy physiological solution, the introduction of the intravenous anesthetic drugs was singularly fortunate since it offered a solution to many of these problems. These drugs, which include thiopental sodium (Pentothal Sodium), thiamylal sodium (Surital Sodium) and hexobarbital (Evipal) are so nearly similar that the inclusive term "intravenous anesthetic drugs" is used in this paper to refer to any one of the three.

In the past, oral surgeons were perhaps too much concerned with the technic of using a specific anesthetic drug and not enough with the principles of general anesthesia. Students now must be trained to become expert anesthetists, not merely anesthetic technicians.

■ *Principles*

The unique advantage of the intravenous method is the introduction of drugs directly into the blood stream with rapid assimilation by the central nervous system. This method by-passes the slower acting respiratory system, where large partial pressures of gas must be built up in stages, breath by breath, by the substitution of gas for nitrogen and with the amount of oxygen unchanged or preferably at even a higher level as inhalation anesthesia is obtained.

It is true that the basic protection against overdosage in this respiratory exchange is not present in the intravenous method, where any amount of drug may be introduced rapidly and without re-

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1. Guedel, Arthur E. Inhalation anesthesia; a fundamental guide, ed. 2. New York, Macmillan Co., 1951.

sistance. The excitement accompanying induction during inhalation anesthesia, however, is a greater hazard, especially for the unusually robust or the cardiac patient, than the hazard of overdosage by the otherwise more favorable intravenous method. Moreover, the light planes of anesthesia in which much oral surgery is performed make the protection afforded by the inhalation technic less critical for oral surgery than for general surgery. Finally, although theoretically the requirement of detoxification is a more serious problem than the elimination of a volatile gas through physical exchange by the way of the lungs, the light levels of anesthesia employed in oral surgery tend to nullify this factor.

Intravenous anesthetic drugs may be used with air, oxygen, inhalant anesthetic drugs, preanesthetic drugs or muscle relaxants. They may be used as the primary drug for induction only or as a basal anesthetic acting as a supplement during maintenance of anesthesia.

At the present time, oral surgeons are divided in their concept of the proper role of the intravenous drugs in oral surgery. It has become popular to speak of balanced anesthesia, as if the mere introduction of several drugs into the body makes for better or safer anesthesia. It is my opinion that the intravenous drugs should be used as the primary agent. No other drugs should be used unless there is a specific indication. If other drugs are used, they should be used as supplements to the intravenous drug.

The resistance to anesthesia is determined mainly by the degree of nervous irritability of the patient. The overcoming of nervous irritability and the control of pain are the two primary objects of general anesthesia. Anesthesia must be deeper to abolish reflex action than to control pain. The metabolic rate of the patient is a reliable guide to nervous irritability, and the rate and character of the pulse is a good index of the metabolic rate. Of the factors which influence metabolic rate, emotional excitement is the chief one to be considered.

The exact manner or place in which barbiturates are detoxified is not known, but they are metabolized much more slowly than was formerly believed. Clinical detoxification is the result of the withdrawal of the barbiturates from the blood stream into the body fat, at least for thiopental sodium and probably for others in similar use.[2] The body fat apparently gives up the barbiturate approximately at the rate at which it is detoxified in the blood. The total dose is, therefore, one of the primary factors in recovery time. Clinically, the detoxification proceeds in direct relation to the metabolic rate of the patient; that is, the higher the metabolic rate the more rapid is the detoxification.

The longer the operation, the greater is the amount of drug required. The recovery time is thereby increased as is the possibility of complications. Every effort should be made, therefore, to perform the required surgery in the most efficient manner lending emphasis to the fact that time is important in surgery. The surgeon should plan a logical sequence of technical steps and adhere to it. Every member of the operating team should be familiar with these steps and always anticipate the

2. Brodie, B. B., and others. Fate of thiopental in man and method for its estimation in biological material. J. Pharmacol. & Exper. Therap. 98:85 Jan. 1950.

surgeon's next move. The materials and instruments must be immediately at hand so that lost time is kept to a minimum. Quiet surroundings also are of great importance when the operation is performed at a light plane of anesthesia.

Since control of the respiratory function is the chief problem, it is preferable to have the patient in the sitting position, the position which permits the greatest volume of respiratory exchange.[3] Furthermore, in this position there is less tendency for the tongue to fall back and occlude the airway, and blood and mouth secretions are more easily removed by suctioning than when the patient is supine.

The apparatus for the administration of the drug should be simple; the primary considerations are ease of cleaning and provision for rigid asepsis. Convenience and ease of injection, readily determined total dosage and minimum wastage also are important factors related to the apparatus. Flexible tubing between the needle and the solution reservoir prevents dislodgment of the needle by arm movements of the patient while he is under light anesthesia.

When a given amount of intravenous anesthetic drug is injected into the blood stream, it is concentrated in the central nervous system because of the rich blood supply in that organ; from there it is distributed uniformly throughout the body tissues, ultimately accumulating in the body fat. The understanding of this process is the key to a successful technic of management.

Intermittent administration, producing alternate depression and near recovery of the central nervous system is more desirable than slow administration, which produces uniform saturation of all tissues. The depression of the nervous system which accompanies the concentration of the drug in the central nervous system allows time to complete a short surgical procedure. As the effect wears off and more time is needed, an additional fractional amount of the drug will again depress the central nervous system. Additional minute amounts may be administered repeatedly until the surgical procedure is completed.

There are no absolute contraindications to the use of intravenous anesthesia, but there are some conditions which require special caution in their management as in the management of any anesthesia. The literature lists an imposing array of such conditions. Among the common ones are cardiac disease, asthma, extremes of age, anemia, general debility, shock, pulmonary disease and inflammatory processes of the head and neck. These conditions call for great care, minimal dosage and maximum oxygen; but with experience and the development of skill in the use of the drug they can be managed safely under intravenous anesthesia. The absence of excitement during induction and the possibility for continuous oxygen administration may even make intravenous anesthesia by experienced operators the method of choice for some of these otherwise contraindicating conditions.

■ *Premedication*

Anesthesia may properly be said to begin with premedication. It is, therefore,

3. Case, E. H., and Stiles, J. A. Effect of various surgical positions on vital capacity. Anesthesiology 7:29 Jan. 1946.

important to consider premedication carefully in its relation to the over-all problem of anesthesia and emergence. Too often in both the hospital and the office, premedication has become a matter of routine rather than of adaptation to the individual case. Such routine employment results in unnecessary or inadequate medication on many occasions.

Drugs used for premedication are all depressants of either the central nervous system or of the autonomic nervous system. Central nervous system depressants such as morphine sulfate or meperidine hydrochloride (Demerol) depress respiration and metabolism. The dosage of such depressants, when used in combination with intravenous anesthetic drugs which are also respiratory depressants, must be carefully controlled to avoid a drop of the respiratory exchange below an acceptable physiologic level.

Parasympathetic depressant drugs, such as atropine and scopolamine, supposedly depress the activity of the pharyngeal and laryngeal reflexes and certainly depress secretory activity. When the parasympathetic system is depressed, however, the activity of the sympathetic system automatically is increased with a resultant increase in the metabolic rate and the need for oxygen. Thus patients who receive atropinelike drugs preoperatively without an accompanying central nervous system depressant actually will require a greater amount of anesthetic drugs than those without such medication. Some benefit, besides the drying effect, may accrue, however, in the form of shortened emergence time.

Premedication should be used only when there are specific indications, and it should not be employed routinely. Valid indications are overexcitement of certain types of patients, anticipated need for pain relief in the postanesthetic phase, and, possibly, depression of the parasympathetic reflex phenomena.

Although it is true that patients given central nervous system depressant drugs preoperatively require less anesthetic drugs, it is true also that recovery time is prolonged. This is an undesirable effect in a practice where the patients are ambulatory. Recovery or emergence from anesthesia, induced by an intravenous drug, depends on the destruction or inactivation of the drug by metabolic processes, so that any drug which slows metabolism slows also the elimination of the anesthetic drug. Therefore, it is better to avoid routine preoperative depression of metabolism in order that the patient may eliminate the anesthetic drug in the shortest possible time.

Whenever it seems advisable to give premedication, it is preferable to give the drug intravenously immediately before the administration of the anesthetic drug and through the same needle. This method allows a more accurate and smaller dose, produces a much quicker effect, and eliminates an additional unpleasant procedure for the patient.

The state of overstimulation immediately preceding general anesthesia is almost strictly a phenomenon of dental practice and is rarely observed in the hospital operating room. It is characterized by acute awareness and apprehension, a bounding pulse with a decided increase in rate, and general autonomic stimulation with a resultant sharp increase in metabolic rate.

Overstimulated patients present no great problem for short operations, for although they require relatively large amounts of the intravenous drug, the drug is detoxified quickly. For long and difficult operations, however, these patients should be evaluated on the basis of their blood pressure and hemoglobin level.

Overstimulated patients with normal or elevated blood pressures and normal hemoglobin values should have a preanesthetic central nervous system depressant. Otherwise, the objectionable circulatory effects of overstimulation may not be reduced to reasonable levels under light intravenous anesthesia. Furthermore, without preanesthetic depression the large amount of intravenous drug required might reduce unduly the margin of respiratory safety and also quite possibly result in postanesthetic depression.

Overstimulated patients with low blood pressure and low hemoglobin values are the most difficult to manage in office practice because of their lower metabolic rate and the depression which follows cessation of painful stimuli. Central nervous system depressants should be used sparingly, if at all, because of their prolonged effect. Such patients seem to be managed best by the administration of an inhalant supplement; usually only small amounts of anesthetic gases are needed. It is desirable to keep the oxygen intake high, rather than to maintain an arbitrary percentage.

Meperidine hydrochloride is perhaps the central nervous system depressant of choice in oral surgery because it depresses respiration less than morphine, produces fewer undesirable side effects, and has the additional property of depressing the activity of the secretory glands of the mouth and pharynx. It is not miscible with solutions of barbiturates because of a wide difference in pH which causes precipitation; therefore, it must be administered separately.

One method of administration is as follows: First 100 mg. of barbiturate is injected to put the patient in a less apprehensive mood; blood is then drawn into the syringe to clear the needle of that drug. Meperidine hydrochloride, 25 to 50 mg., is then given very slowly, that is, in a period of about two minutes—rapid injection may cause vomiting—and blood is again drawn into the syringe to clear the needle. The intravenous drug reservoir is then reconnected to the needle, and anesthesia is induced without delay.

Respiratory depression requiring supportive treatment is uncommon with these dosages; but if it should develop, it is readily corrected by the introduction of oxygen through the nasal inhaler. Again, less total intravenous drug will be needed, but nevertheless recovery time will be increased because of the long-acting depressant effect of the narcotic on the patient's metabolism.

Medication with meperidine hydrochloride can be employed advantageously also to allay or prevent anticipated pain in the postanesthetic phase, for instance, for patients of the middle or late teens after removal of several severely impacted teeth. Without this medication, such patients not uncommonly complain of severe pain on regaining consciousness and become extremely restless and noisy. Such reactions should be prevented because of their bad psychological effect on other patients and on members of their families, and be-

cause of interference with office routine.

Atropine is the preanesthetic drug usually employed routinely, no doubt because it is still considered essential by many medical writers. This opinion may be a holdover from the days of irritating inhalation drugs. It is supposed that its parasympathetic depressant effect will prevent or decrease the likelihood of laryngeal spasm. The evidence that it actually has this effect is open to question. My observations indicate that it has no such effect and I no longer use it in my office.

It does depress the action of the secretory glands, however, and for this reason may be considered desirable by some oral surgeons for long operations. It seems preferable, nevertheless, to manage secretions and reflexes without a special anesthetic agent.

If atropine is administered immediately before or simultaneously with the intravenous drug, it takes effect too slowly to be of benefit during a short operation, and the drying effect is not desirable in the postanesthetic period.

■ *Induction*

Induction is the phase, initiated by the beginning of administration of the drug, during which the patient progresses to a level of anesthesia at which the surgeon can start the operation.

The time taken to reach this level depends on the metabolic starting point, the rate of injection and the accurate estimation of dosage. Progress will be smoother and there will be fewer undesirable side effects when this level is reached in approximately a minute or less. The size of the needle and the injection equipment should be selected with this fact in mind. Rapid and smooth induction is of the utmost importance because many anesthesias begin and end there. It is of great importance also to inject a sufficient amount of drug to produce quickly a short-lasting depression of the cerebral cortex.

The ability to estimate the correct dosage comes only after a long experience with weighing such factors as metabolic rate, age, weight, general physical condition and race, as well as emotional and pain response. The slight degree of depression desired is evidenced by a transitory apnea similar to a sigh, so slight many times as to escape the notice of the uninitiated. Immediately thereafter the surgeon has time to complete a short procedure. This phenomenon is one of the prime advantages of the drug, and to lose this advantage by failing to recognize it or by waiting for slower-acting inhalational adjuncts to take effect is to fail to utilize the full potentiality of the drug.

For slightly longer procedures it is possible to estimate and inject a larger initial amount, sufficient to complete the work. The oral surgeon at this point takes advantage of the fact that the emergent phase in intravenous anesthesia is considerably longer than the inductive phase. A slow emergence phase may be considered a disadvantage by some in the definition of an ideal anesthetic drug, but the oral surgeon can turn it to his advantage by synchronizing pain production with the level of anesthesia and completing the less stimulating steps in the technic as the patient returns to consciousness.

For operations in which a surgical level must be maintained over a relatively

long period of time, the precise dosage for induction is not quite as important, provided that it produces a prompt effect but does not depress respiration to the point at which it must be supported.

Certain physical states, such as impaired circulation from any cause, lessened oxygen-carrying capacities, and pregnancy, demand that oxygen levels in the blood be maintained at a maximum. Ideally, oxygen by way of the nasal inhaler should be administered to such patients before the introduction of anesthetic drugs. If the nasal inhaler is objectionable or introduces an added excitement factor, however, it should not be put in place until after consciousness is lost.

A disadvantage of having the patient in the sitting position is that syncope sometimes develops before intravenous anesthesia is actually begun. Even though its onset is observed and oxygen is supplied through the nasal inhaler, the patient may lose consciousness before the drug can take effect. The patient must then be considered in a state of shock with the restoration of circulatory efficiency the first objective. The back rest is lowered to allow the head to become level with or below the trunk, and the administration of oxygen is continued. The injection of the anesthetic drug is stopped. As soon as peripheral circulation is reestablished, and normal color returns, more of the anesthetic may be given as needed to prevent complete emergence. The patient may be returned to the sitting position gradually, or the operation may be performed with the patient reclining.

Finally, there are patients who are resistant to intravenous drugs. Ideally, these patients should be recognized before administration is begun. It is folly to continue the administration of any drug which is not having the desired or expected depressant effect. Reason dictates an additional depressant rather than the forcing of the primary drug beyond physiological limits. A half gram of thiopental sodium is taken arbitrarily as the upper limit for induction. If this amount does not produce the desired level, another depressant should be introduced. This may be an intravenous drug, such as meperidine hydrochloride, an inhalant such as nitrous oxide or a combination of both.

Nitrous oxide is the additional depressant of choice for most oral surgeons; however, I use it only as an additional depressant and not as a primary or indispensable drug. It must be remembered also that intravenous drugs change the respiratory pattern, with the result that the increase in respiratory rate and amplitude normally accompanying induction with an inhalant will not occur. Consequently, if nitrous oxide is used, considerably more time must be allowed for the substitution of nitrous oxide for the nitrogen in the blood. It is for this reason that it is not desirable to supplement intravenous anesthesia with nitrous oxide-oxygen in the usual short oral surgical procedure; the depressant effect of the rapid-acting intravenous drug is dissipated before the inhaled anesthetic takes effect.

An exception must be noted in the management of anesthesia for children. Although many children have had previous unpleasant experiences with inhalation anesthesia, they anticipate intravenous anesthesia with pleasure, having

been told of its pleasant effects by their parents. As a rule in such cases venipuncture is accomplished easily; and a small amount, 20 to 100 mg. of the intravenous drug, is injected. This amount is not enough to provide surgical anesthesia or to depress respiration appreciably, but it is enough to allow the administration of the inhalant without resistance from the child and to permit maintenance of the oxygen percentage at or above physiological requirements. The high metabolic rate of children causes rapid detoxification of the intravenous drug.

This method is especially desirable for operations in the anterior part of the maxilla, where the retraction of the soft tissues often interferes with the correct position of the nasal inhaler. The resulting gas leakage, of course, interferes with an otherwise easy inhalation technic.

■ *Maintenance*

Anesthesia should be maintained at a plane sufficiently deep to protect the patient against painful stimuli and to enable the surgeon to perform his work readily, but no deeper. That anesthesia is best which most often places the patient closest to consciousness while it is accomplishing its purpose. It is, therefore, essential that the anesthetist have a thorough knowledge of the technical steps in the operation so that the depth of anesthesia may be varied with the intensity of painful stimuli.

Most office procedures can be performed under light planes of anesthesia, usually above the vomiting reflex level. At this plane the swallowing and cough reflexes are active, the lash reflex is depressed or momentarily eliminated, the pupillary reflexes are present, and respiration is adequate for physiological needs. A light plane of anesthesia with the patient close to consciousness during the operation is the chief factor of safety in intravenous anesthesia as opposed to inhalation anesthesia, under which the patient must be maintained below the vomiting level for safety.

The most convenient practical guide to the depth of anesthesia for dental surgery is the lash reflex. Fractional amounts of anesthetic drug are injected to keep this reflex depressed or eliminated only momentarily. A smooth level of anesthesia is not the aim but rather an undulating pattern with the depth varying from too shallow to just adequate. By this method the injection rate will balance the detoxification rate. If there is too much bodily movement or if reflexes are initiated, the level of anesthesia can be deepened quickly. As the operation progresses, smaller increments of the drug suffice because of the slow detoxification rate. The final goal of the oral surgeon should always be to finish each operation with his patient conscious.

Some patients cannot be maintained in the manner just described because of the activity of their cough and laryngeal reflexes. These reflexes must be obtunded in order to avoid troublesome interruptions. Supplementation of the intravenous drug with nitrous oxide-oxygen is excellent for this purpose.

The laryngeal reflex may be initiated through direct stimulation of the vocal cords by contact with blood, saliva, postnasal mucus, secretions from the mucous glands in the soft palate and pharynx or interference with the airway, or even by

indirect stimulation from distant pain. Direct stimulation can be prevented by the removal of secretions and by strict attention to respiration. Avoidance of indirect stimulation depends on synchronizing the depth of anesthesia with the intensity of pain.

Throat packs, necessary when inhalation anesthesia is used alone, are contraindicated, because the reflexes in the throat are active under light anesthesia and packs are not tolerated. In addition, the patient should be permitted to breathe through his mouth as well as through his nose. The material placed on the dorsum of the tongue to prevent foreign bodies or secretions from entering the pharynx should be employed as a sponge and a barricade rather than as a pack. Additional absorbent material is placed adjacent to the operative site and changed as frequently as it becomes saturated.

Fluid accumulation in the pharynx causes a gurgling sound and should be managed by telling the patient to swallow or by aspiration before it spills over into the glottis. It is well to keep the aspirator along the lateral walls of the pharynx, aspirating the piriform sinuses and avoiding the midline of the glottic region.

Respiration must be the constant concern of the successful operating team. Any interference with free exchange should be eliminated immediately. A team ever alert to the vital importance of unimpeded respiration will rarely encounter difficulties. Corrective measures must be instituted at the first incomplete respiratory effort, and not delayed until an oxygen-carbon dioxide imbalance has become manifest.

There may be muscular movements under light intravenous anesthesia, but they are not sudden or violent. Restraints are unnecessary, and their visible presence creates a bad psychological atmosphere. As anesthesia lightens and pain impulses penetrate the anesthetic barrier, the body and legs usually stiffen before the arms move to protect the site of pain origin, allowing time to deepen the anesthesia before the patient interferes with the operation.

The administration of pure oxygen after intravenous anesthesia does not decrease the recovery time because the drug is not eliminated by way of the lungs and oxygen does not increase the basal metabolic rate appreciably.

■ *Cardiac Arrest*

Cardiac standstill is at the present time the center of much interest, for it is the most serious emergency encountered during general anesthesia. Frequent references are made in the literature to the need for rapidly applied cardiac massage and to the methods which should be employed for its accomplishment. Prevention of cardiac standstill, however, remains the point of paramount importance. This is accomplished best by teaching the principles and reiterating the need for adequate oxygenation, for cardiac arrest in dental patients is almost universally the result of myocardial anoxia. Continual provision for adequate oxygenation has almost entirely prevented this catastrophe in large series of cases.

■ *Postanesthetic Care*

One of the typical and pleasant side effects is the euphoria exhibited by patients during their emergence from intravenous anesthesia. Unless they have been unduly depressed, they are happy, talka-

tive and complimentary. The widespread enthusiasm for this method among patients is largely a result of this reaction. Patients must go through the same stages of anesthesia in reverse during emergence, but the second stage is likely to be much longer than induction. It is important therefore to bring the patient as close to consciousness as possible and to finish the operation with the patient awake or nearly so, since the deeper the depression, the less the euphoria.

The recovery room in modern surgical practice has proved its value in hospitals. Similarly, safety and success in office practice require that one person be assigned to postanesthetic care and that all members of the team be alert constantly for breath sounds and other significant noises during recovery. Anesthesia sometimes deepens with the cessation of painful stimuli, and the tongue may drop back and impinge on the airway.

Ideally, at the completion of surgery, the patient should move himself from the dental chair on command; if he does not respond to the command, he can be slid onto a wheel chair and from there to the bed in the recovery room. He is then positioned on his side, with his face away from the wall and his head on a low pillow. A restraint to keep him in bed is either fastened or put in place. A side position with the head low will allow saliva or blood to drool from the mouth rather than into the pharynx and also will keep the tongue from dropping back. Ice bags may be placed over traumatized regions, and the patient may be encouraged to rest or sleep. Packs must be checked periodically and changed when saturated. If time permits, patients should be allowed to awaken naturally because this sleep is especially enjoyable, and some patients resent being awakened.

On awakening and sitting up, many patients will complain of dizziness and some of diplopia. Diplopia is usually transitory, but dizziness may persist and be followed by nausea and vomiting. Fortunately, dizziness, too, is of short duration and of little consequence for the great majority of patients.

During emergence some patients, especially those in the second decade of life, may be restless and complain of pain; fortunately most of them have no remembrance of the pain because of the temporary amnesia produced by the drug. For this reason, unless severe pain is anticipated, little attention is paid to their complaints. Nevertheless, in some cases, a sedative is necessary, especially for older patients who complain of pain in the chest or epigastrium. It is wise to give relief if the pain is thought to be of possible cardiac origin.

Patients who react normally are given a cup of black coffee or tea as an analeptic to hasten the emerging process. Patients reluctant to accept coffee or tea should not be forced to take it, since the usual result under those circumstances is regurgitation. The need for more potent analeptics is evidence that the amount of intravenous drug was unnecessarily large and that full advantage of the drug's qualities was not taken.

Contrary to the literature, vomiting is a problem after intravenous anesthesia for oral surgery. Most vomiting is confined to one episode, although nausea may continue and there may be additional bouts of vomiting in some cases. It is true that intravenous anesthetic drugs do not stimulate the vomiting reflex, but it takes

an extremely strong stomach to accept and retain a quantity of fresh blood. It seems impossible during emergence to prevent some patients from turning on their backs or dislodging mouth packs over the bleeding regions.

Patients who are subject to motion sickness may be benefited by dimenhydrinate (Dramamine). For patients who have always been nauseated after general anesthesia with any drug, preoperative suggestion is sometimes effective in breaking the habit. By far the most frequent reason for vomiting is a highly nervous state.

It is possible merely by preoperative observation to predict with a fair degree of accuracy which patients will vomit. Vomiting tends to be prolonged for such nervous patients. The soft drink "7-up" is a fairly satisfactory remedy for nausea and vomiting. During 1952, 191, or 6.7 per cent, of 2,848 patients vomited after operations under general anesthesia. This group included patients in whom anesthesia was produced by inhalant and intravenous drugs, either separately or in combination.

Postanesthetic headaches are much less frequent than formerly. There seems to be no effective treatment, but in many cases the headache can be prevented by allowing the patient to have his customary morning coffee.

Extravenous leakage of the anesthetic drug or pain at the site of injection is treated by the infiltration of procaine into the region.[4] No untoward effects have been observed. The dilute 2 per cent solution contributes to safety in this regard.

When the person in charge is satisfied that the patient is able to leave the office, he is supplied with written postoperative instructions and a sedative or a prescription for a narcotic. A patient should be accompanied home and in no case should be permitted to drive a car.

■ *Postoperative Medication*

Another advantage of intravenous anesthesia compared with other forms of anesthesia is that patients experience less afterpain. The prolonged pain-obtunding effect may be due to the slow elimination of the drug. The common practice of prescribing a long-acting barbiturate for sedation the first night after surgery is unnecessary and even contraindicated for ambulatory patients after intravenous anesthesia. Such an additional barbiturate is usually very slowly metabolized, and its effects may be felt for the next day or two. Aspirin is sufficient to relieve discomfort after slight trauma; codeine or meperidine hydrochloride is prescribed after severe trauma. In calculation of dosage for postoperative sedation, consideration should be given to the anesthetic drug which was used.

■ *Summary*

Intravenous anesthesia is the solution to one of the important problems of dental anesthesia. There is evidence to prove that this method deserves extended use. Anesthesia should be managed with the intravenous drug in the primary role; secondary drugs should be selected carefully to meet the physiological needs of the patient. The most important forward step in dental anesthesia of the last decade is the use of the intravenous method by practitioners well grounded in the principles of good anesthesia.

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VOLUME 13 • APRIL 1955 • NUMBER 2 CASE REPORTS

Odontogenic myxofibroma of the mandible: *report of case*

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The following case illustrates the aggressive behavior of a connective tissue neoplasm with benign histopathologic features.

A four year old white boy was first seen at University Hospital on August 11, 1953. He had been referred for definitive treatment of a tumor of the right side of the mandible. The history of this complaint dated back to February 1953 when the boy was reported to have fallen and sustained a blow to the right side of the face, after which there had been persistent swelling of the right side of the lower jaw. After one month, the patient had been taken to an oral surgeon in another part of the state, who found on clinical and roentgenographic examination (Fig. 1, left and center) a destructive lesion in the posterior body of the mandible, beneath the crown of a developing first permanent molar. There had been moderate swelling over the lesion caused by the expansion of the mandible, but there was no tenderness or other sign of inflammation associated with the lesion. A biopsy had been performed under general anesthesia, and the report, from another hospital, stated the lesion to be a "cystic odontogenic tumor" involving the right side of the mandible. Although the patient had been referred to University Hospital at that time, a delay of four months intervened, during which time the tumor was relatively asymptomatic and increased in size gradually. The child had remained relatively well, and there had been no associated weight loss or other constitutional disturbance.

EXAMINATION—When first seen in August 1953 the child appeared to be in no significant distress, but there was a large, firm and regular swelling that involved the posterior one third of the body of the mandible on the right side, extending into the angle region. The mass was not tender, but there was an associated trismus. Intraoral examination revealed the site of previous biopsy to be well healed and revealed no signs of ulceration or inflammation. Laboratory findings were all within normal limits.

Roentgenograms of the mandible showed a destructive lesion, which involved a larger area than had been revealed in the original films, in the region of the posterior body of the mandible (Fig. 1, right). Roentgenographic findings of the skull and chest were negative. On August 13 a biopsy of the lesion was performed intraorally under general anesthesia. The pathological diagnosis of the specimen suggested either a neurofibroma or the so-called myxoma or myxofibroma of central origin, which has been designated as an odontogenic neoplasm.

OPERATION—On August 19 the lesion was excised en bloc through an intraoral approach. The greater portion of the mandible in the region of the tumor was found to be destroyed, and only a thin lateral cortical plate remained.

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Fig. 1—Left and center: Original appearance of osteolytic lesion of the mandible associated with the developing right first permanent molar. Right: Advancing mandibular destruction five months after original diagnosis

Immediately anterior to the angle of the mandible there was a pathologic fracture through the lateral cortical plate. Because of the loculations and extensions of the tumor, total excision probably had not been accomplished in some of the soft tissues around the mandible. Thermocautery was used in these regions. The defect resulting from the surgical intervention was dressed with petroleum jelly gauze, and the mandible was stabilized by means of loop wiring to provide intermaxillary fixation.

PATHOLOGY REPORT—The pathological diagnosis of the specimen was again "fibroma with some areas of myxofibroma." The reports further stated: "The lesion is infiltrating voluntary muscle but is not sufficiently cellular to be considered sarcoma. Decalcified sections show the same myxomatous and fibrous characteristics of the neoplasm. The fibrous elements are found to be more mature at this time than in the sections from previous biopsies." The surface characteristics of the lesion are shown in Figure 2, left, in the immediate submucosal area. The more filamentous myxomatous regions from the central portion of the tumor are shown in Figure 2, right.

POSTOPERATIVE COURSE—During the succeeding two weeks, the intraoral dressing was

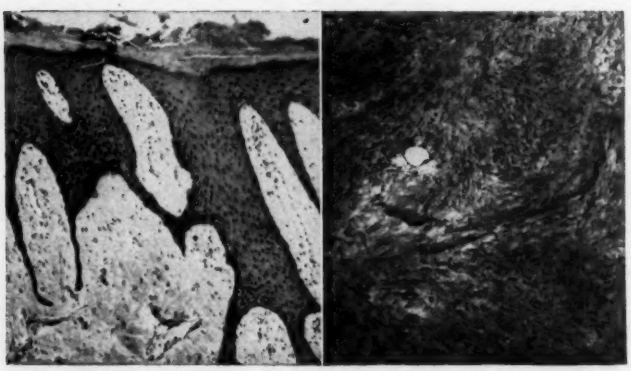

Fig. 2—Left: Surface characteristics of mature fibroblasts. Right: Central myxomatous nature of the tumor

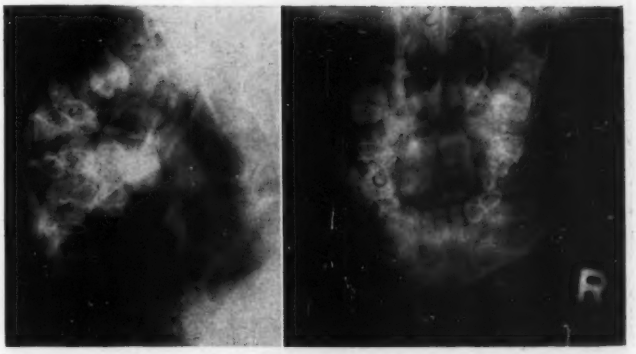

Fig. 3—Mandibular defect after resection of tumor through intraoral approach five months after original diagnosis. Intermaxillary wires stabilize pathologic fracture

changed periodically, and healing proved to be satisfactory. After three weeks, the mandible appeared to function normally in spite of the pathologic fracture; therefore, the intermaxillary fixation was removed and the patient discharged. Roentgenograms of the postoperative condition at the time of discharge are shown in Figure 3. The parents were instructed to return the child immediately if there was any indication of pain or swelling and were asked to protect him from falls and to curtail rough play and strenuous activity. He was placed on a liquid diet for a period of two weeks, which was gradually changed to a soft diet as tolerated. The parents were also instructed to be alert for any signs of injury to the right lower lip which was anesthetized from loss of the inferior alveolar nerve.

During the succeeding four months, the child was seen on regular monthly visits, and the initial healing was satisfactory. On the third month there seemed to be a gradual increase in the size of the swelling and an increase in trismus. The child was readmitted to University Hospital on December 28, 1953, at which time examination revealed a prominent swelling on the right side of the jaw, with a palpable firm mass 3 by 5 cm. and considerable trismus (Fig. 4). The patient also had an upper respiratory infection at the time of ad-

Fig. 4—Mandibular swelling produced by expanding tumor four months after intraoral operation

Fig. 5—Residual defect and fracture four months after intraoral operation

mission which required several days of supportive care before anesthesia could be used. Chest roentgenograms and laboratory findings were essentially normal, and there was no evidence of metastasis to the regional lymph nodes.

Roentgenograms of the mandible showed the changes caused by the previous operative procedure and a residual fracture through the angle of the mandible on the right, with no evidence of bony union and increasing destruction of the ascending ramus of the mandible. The noticeable irregularity of the mandible as shown in the previous roentgenograms had become smoother which indicated that there had been a partial attempt at repair (Fig. 5). After a preliminary course of antibiotics and supportive care, another intraoral biopsy of the mass was performed without complication. The pathologist's report was identical to that of previous descriptions of the tumor, without any increase in cellularity or indication of malignant change.

SECOND OPERATION—On January 7, 1954, a bloc excision of the tumor mass was carried out through an extraoral approach. An incision 8 cm. in length was made below the inferior border of the mandible, extending from the angle to the submental region. The subcutaneous tissues were retracted, and the platysma muscle was incised to expose a lateral capsular boundary extension of the tumor mass. This was the only region where a capsular boundary was found. Anteriorly, the periosteum was incised over the inferior border of the mandible, and the anterior extension of the tumor destruction was identified 1 cm. posterior to the mental foramen.

Further dissection revealed the tumor to be invading the submaxillary gland medially and inferiorly, and bloc dissection was carried out to include these structures. The tumor was then followed posteriorly and was found to be adherent to the anterior border of the sternocleidomastoid muscle. By sharp dissection, the tumor was excised from its bed on the posterior and inferior surfaces. The cervical nerves of the region were involved in the tumor and were divided for inclusion in the bloc dissection. Superiorly, the tumor boundary was at the mid level of the ascending ramus of the mandible. The parotid gland and seventh nerve had been retracted superiorly, and a transverse incision was made across the masseter muscle and through the bone of the ascending ramus. This osteotomy was above the superior limit of osseous destruction by the tumor.

The tumor mass extended medially into the infratemporal fossa where it was adherent to the pterygoid muscles. The regions of involvement were excised by sharp dissection, and a specimen 6 by 4 by 4 cm. was removed en bloc, including the mandible, the submaxillary gland, and the regional lymph nodes. The external maxillary artery and other regional vessels of significant size were doubly ligated. The incised margins of the oral mucosa were closed with no. 000 chromic sutures, and the remaining margins of the mylohyoid muscle were sutured to the remaining portion of the internal pterygoid muscle.

A stainless steel plate was adapted to approximate the contour of the resected mandible. Two drill holes were placed near the posterior border of the base of the condyle, and the stainless steel plate was ligated to this proximal condylar fragment by means of 25 gauge stainless steel wires. Anteriorly, the plate was

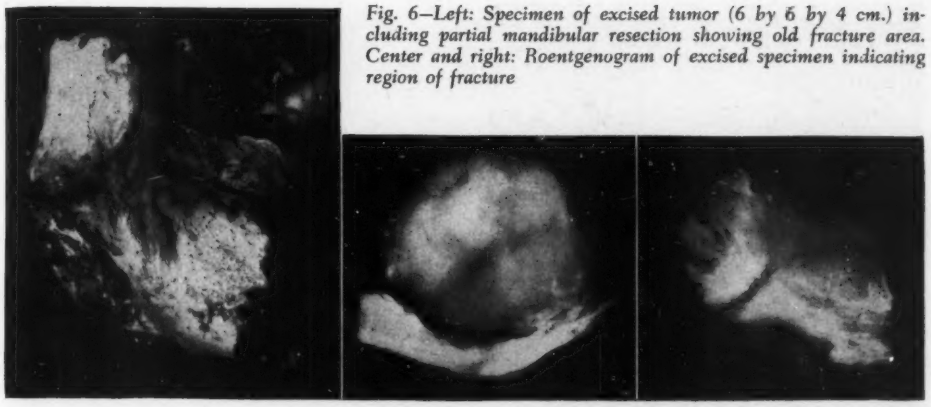

Fig. 6—Left: Specimen of excised tumor (6 by 5 by 4 cm.) including partial mandibular resection showing old fracture area. Center and right: Roentgenogram of excised specimen indicating region of fracture

attached to the inferior border of the distal fragment of the mandible by means of a stainless steel screw into the body of the mandible. The remaining portion of the masseter muscle was sutured to the stainless steel plate, and the platysma layer and remaining fascial layers were closed over the stainless steel bar. A Penrose drain was inserted into the deepest portion of the defect, and the skin margins were approximated without tension. A pressure dressing was applied over the area. The patient received a transfusion of 500 cc. of whole blood during the prolonged procedure and was in good condition when he left the operating room.

The excised specimen is shown in Figure 6, left, and roentgenograms of the excised specimen are shown in Figure 6, center and right. Pathological diagnosis again indicated histologic characteristics of fibroma with some areas of myxomatous tissue. Various sections of the tumor indicate its extensive invasive

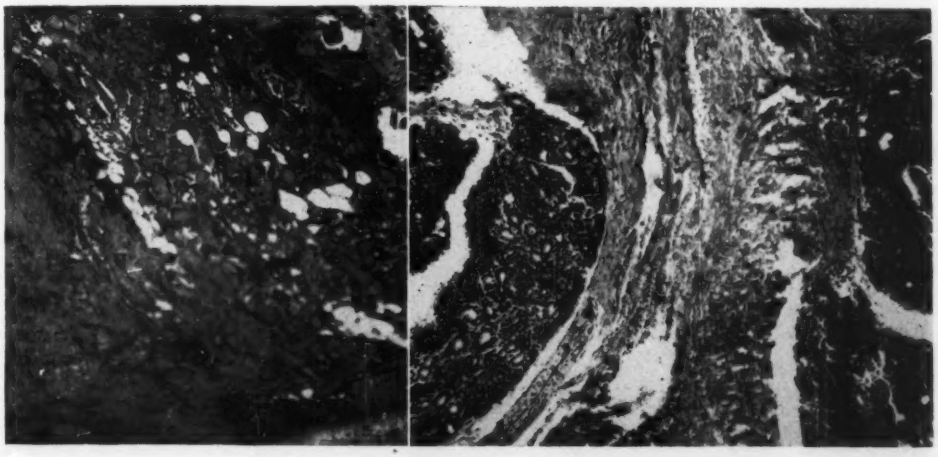

Fig. 7—Left: Invasion of adjacent voluntary muscle at periphery of tumor. Right: Invasion and destruction of submaxillary gland by tumor

Fig. 8—Marrow replacement by fibrous tissue in the tumor specimen

nature. The infiltration and destruction of muscle are shown in Figure 7, left, and the invasion of the submaxillary gland is shown in Figure 7, right. Focal areas of fibrosis in the marrow spaces on the decalcified specimen are shown in Figure 8. Roentgenograms of the right side of the mandible revealing the operative defect and the Sherman plate fixation of the fragments are shown in Figure 9.

POSTOPERATIVE COURSE—The child's convalescence from the operative procedure was uneventful, with uncomplicated and rapid healing. Drainage was minimal, and the drain was removed on the second postoperative day. He was discharged on the tenth postoperative day, with the request to return in one month for postoperative supervision. During the past six months, the patient has been seen on regular visits and has made excellent progress. The occlusion has remained normal, and there is evidence of good mandibular function with normal condylar movement.

Clinical examination and roentgenograms have not revealed any evidence of recurrence or metastasis. Complete healing has taken place, and the child has maintained normal activity. His growth and development have been normal, with regular gains in weight. Roentgenographic examination has not shown any change in the position of the Sherman plate, which has maintained the fragments in position for future grafting procedure. His facial appearance is relatively normal (Fig. 10), and roentgenograms have remained unchanged.

DISCUSSION—This has been an extremely interesting case in view of the benign histopathologic characteristics of the tumor as revealed in pathology reports, as contrasted to the very aggressive clinical behavior with rapid infiltration of regional structures. The frequent biopsy procedures before each operation checked any possible change in the histologic characteristics and ruled out sarcomatous

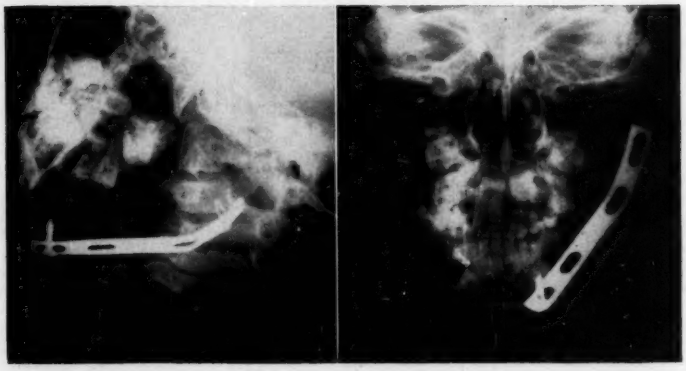

Fig. 9—Fixation of mandibular fragments by stainless steel plate

Fig. 10—Facial appearance six months after excision of tumor

changes in the recurring neoplasm. Myxomatous tissue is relatively frequent in odontogenic regions of the jaws.[1,2] Since there were no calcified structures detected in any of the material submitted, this tumor cannot be classified as a true odontogenic fibroma. The cementumlike substance usually found was not seen. The tumor reported here has the histological characteristics of myxofibroma as described by Thoma.[3] It is hoped that through preservation of the mandibular condylar fragment the future deformity of the mandible in this instance may have been minimized.

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■ SCIENCE

Besides ministering to our comfort, science also serves to satisfy certain needs of the human spirit. It helps us to understand the world and to feel at home in it. We are distressed by disorder, and always try to arrange in order the things with which we have to deal, whether they are the affairs of a nation, the books in the library, or our own ideas. Science satisfies us because it shows us that, behind the transient and confused pageant of nature, there is a permanent and orderly reality. And it was in the sky that this order was first revealed to men on a vast and spectacular scale.—*A. Armitage, "Sun Stand Thou Still," 1946.*

Odontoma, complex type:

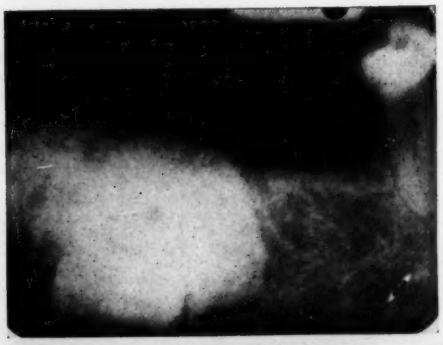
report of case

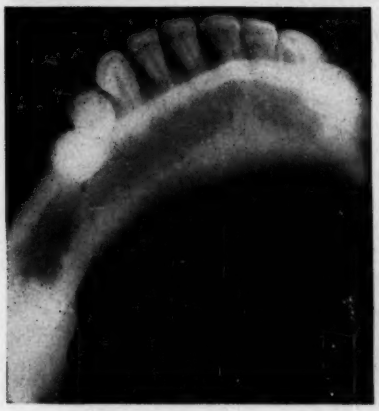
■ *Leroy C. Andersen, D.D.S., Jamestown, N. D.*

The patient, a young woman aged 22, was referred for examination and treatment on January 26, 1940. Her chief complaint was discomfort caused by an obvious swelling on the left side of the mandible. This had developed gradually, and there had been no pain until shortly before she came for treatment.

Clinical examination revealed the absence of the lower left first, second and third molars, an extremely noticeable enlargement of the mandible lingually, buccally, and on the mandibular ridge in the molar region. There was no crepitation.

Intraoral roentgenograms (illustration, above) were insufficient to cover the area, but the occlusal view (illustration, below left) successfully recorded a radiopaque mass protruding on the lingual aspect of the mandible. The ex-





Left: Intraoral roentgenogram. Below left: Occlusal view showing radiopaque mass protruding on lingual aspect of mandible. Below right: Extraoral view

traoral roentgenogram (illustration, below right) revealed that the mass extended from the mandibular ridge of the second molar area downward toward the inferior border of the mandible, and it engulfed the crown of an incompletely developed third molar. The tooth apparently was being forced through the inferior border of the mandible by the continuous growth of the mass. The first impression was that it was an odontoma.

The tentative plan of treatment was first to remove the molar externally so as to avoid a possible fracture of the mandible, and then to remove the odontoma at a later date. Since the region was painful, however, and there were increasing signs of an acute infection, the entire operation was performed intraorally January 28.

The patient was premedicated with morphine, ⅛ grain, and atropine, 1/150 grain, and anesthesia was induced with a mandibular and long buccal block with intermittent use of nitrous oxide-oxygen analgesia. An incision was made on the crest of the ridge extending from the retromolar region anteriorly to the second bicuspid. The flap was retracted and the tumor exposed. A slight purulent discharge was evacuated at this time.

Since the mass was immovable, it was dissected out a section at a time to expose the third molar, which was then easily removed.

At the completion of the procedure, the mandibular nerve trunk was plainly visible in the wound. The posterior two thirds of the incision was sutured and an iodoform gauze drain was inserted in the anterior portion. This dressing was changed every two days for a ten day period. The wound was then irrigated with a sterile saline solution, suction was applied to remove all fluids, and a bone wax dressing was inserted. Recovery was uneventful except for a slight paresthesia.

Microscopic study of the tumor revealed it to be made up entirely of calcified masses which were recognizable as dentin and cementum. The diagnosis was odontoma, complex type.—*Flint Building.*

Unusual foreign body in the mandible:

report of case

■ *G. Thaddeus Gregory,* D.D.S.; Glenn J. Pell,† D.D.S., and William G. Shafer, ‡ D.D.S., Indianapolis*

A considerable number of reports can be found in the literature that discuss the presence of foreign objects in the soft tissues and the bone of the oral and perioral structures. Such reporting should be encouraged because of the diversified nature of these objects, the varying pattern of the clinical and roentgenographic findings in such cases, and because of the help such reports furnish the oral surgeon. Most of the foreign objects that have been reported consist of such artifacts as broken syringe needles, broken dental instruments, filling materials accidentally dislodged during extraction, packing materials, and so on.

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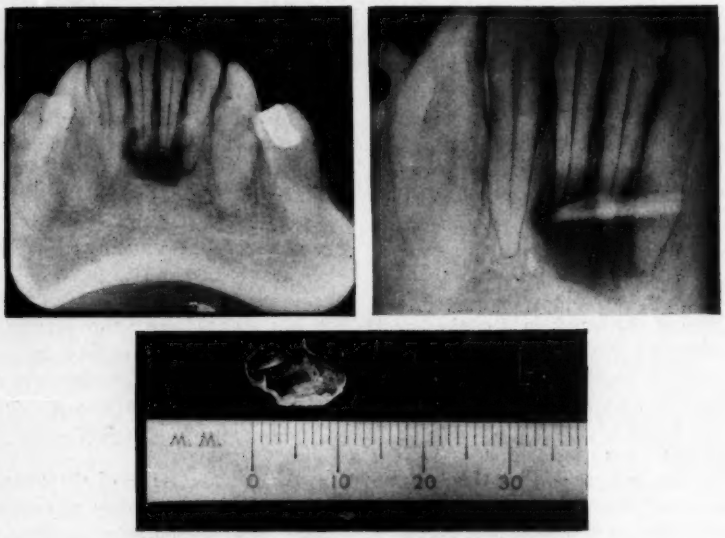
†Professor of oral surgery, department of oral surgery, Indiana University School of Dentistry. Deceased.

‡Assistant professor of pathology, department of oral pathology, Indiana University School of Dentistry.



Above: Periapical and occlusal roentgenograms showing foreign body. Below: Piece of glass seen in roentgenogram

The present report is presented because of the unusual nature of the foreign object and because of the period of time that had elapsed before clinical signs were manifested.

A 34 year old man visited his physician with the chief complaint of a fistula that had been draining through the skin of the chin for approximately three weeks. The patient was referred to a general roentgenologist for examination. In anteroposterior and lateral films of the mandible, a cystlike area involving the lower incisors was detected.

The usual intraoral periapical and occlusal films were taken, and in the mandibular incisor region a large irregular radiolucent area was noted that apparently was associated with the apexes of these teeth. In addition, an unusual radiopacity was noted lying across the apexes of these same teeth. This radiopaque object measured approximately 2 mm. by 11 mm. Some resorption of the apexes of these teeth also was seen (illustration).

Because the involved teeth were the obvious cause for the fistulous tract draining on the skin surface, the lower anterior teeth were extracted, a mucoperiosteal flap was retracted and the soft tissue enucleated. At this point the unusual structure noted in the roentgenogram was encountered and was found to be a round, thin fragment of glass (illustration, below right). Although questioning of the patient had failed to elicit any pertinent information concerning the possible identity of the unusual object noted in the roentgenogram, the patient suddenly remembered during the operation that 14 years previously he had been injured in an automobile accident, and that he had suffered injury to his face from a broken windshield. Since it was a thin piece of glass, it apparently had penetrated the soft tissue and had left only a small mark at the point of entry which could have been mistaken for a superficial laceration.

The patient encountered no postoperative difficulties, and the fistulous tract healed rapidly.

Dentigerous cyst of mandible:
report of case

■ *Martin S. Protzel, D.D.S., Newark, N. J.*

On March 27, 1948, a well developed 37 year old negro woman was referred for diagnosis and treatment. Her chief complaint was a swelling of the tissues of the right side of the face and neck. Two weeks previously, she had become aware of a nodular swelling overlying the body of the mandible on the right side. It had slowly increased in size, and with the expansion she had experienced pain, especially on palpation. History of trauma was denied.

EXAMINATION—Visual examination revealed a swelling of the face and neck that involved the angle, body, and symphysis on the right side of the mandible, and extended into the cervical region to the level of the hyoid bone. On palpation, the mass appeared to be firm, tender, nonfluctuant, and definitely attached to the mandible. In the cervical region, the swelling was loose and edematous. Intraoral examination revealed the oral mucosa on the affected side to be of normal tone and texture. Palpation at a site just inferior and anterior to the second molar produced pain which radiated to the ear and down into the neck as far as the clavicle. There was no elevation of temperature, and the remainder of the clinical examination was negative.

Roentgenographic examination revealed an impacted anomalous mandibular right molar tooth located at the lower border of the mandible, posterior to the mental foramen and anterior to the mesial root of the second molar tooth (Fig. 1, above). A radiolucent area was noted surrounding the coronal aspect of the unerupted tooth and extending superiorly as a tract toward the oral mucosa. What appeared to be extensive internal resorption involving most of the dentin was present.

After clinical and roentgenographic examination, a diagnosis of an impacted anomalous tooth, with an associated dentigerous cyst, was made. Extraction of the impacted tooth, along with the excision of the associated cystic region, was advised. Because of the position of the impacted tooth at the lower border of the mandible, an extraoral approach was selected. It was felt that this method would permit greater accessibility and direct vision with a minimal amount of trauma and would best preclude the possibility of fracture of the mandible.

TREATMENT—With the patient under nitrous oxide-oxygen-ether anesthesia, nasopharyngeal catheters were inserted. The face and neck were disinfected with nitromersol tincture (Tincture of Metaphen) and were draped with sterile towels. An incision, extending from approximately the mesial root of the second molar to the symphysis, was made through the skin 1 cm. below and parallel to the inferior border of the mandible. The subcutaneous tissues, which consisted primarily of a large amount of fat and the platysma muscle and the superficial fascia, were divided, and the periosteum and body of the mandible were exposed (Fig. 1, below left). The bleeding vessels were clamped and tied with no. 000 plain catgut. The periosteum was incised and retracted carefully together with the skin and deeper structures.

A bulge in the cortical plate of the mandible was observed just posterior to the mental foramen. The automatic surgical mallet was employed, and a bone window was created that exposed the crown of the unerupted tooth. Because of the extreme curvature of the roots, the crown was split horizontally (Fig. 1, below left) and removed. This provided adequate space for the subsequent elevation and removal of the

Fig. 1—Left: Preoperative roentgenogram showing impacted tooth. Below left: Extraoral surgical approach. Bone window reveals impacted tooth. Crown has been split horizontally. Below right: Impacted tooth has been removed

root portion. After removal of the tooth, a greyish-blue glistening gelatinous mass of soft tissue was seen adhering to the bone (Fig. 1, below right). The mass extended superiorly to the alveolar crest. It was thoroughly curetted from its bed and was preserved for microscopic study. At no time was there any perforation into the oral cavity since the mass was easily peeled away from the overlying mucosa which was left completely intact. The bone defect was thoroughly irrigated with a saline penicillin wash and the edges carefully saucerized with bone files. The soft tissues were closed in the usual fashion, and a dry gauze dressing was applied.

POSTOPERATIVE COURSE — Postoperative roentgenograms revealed that the unerupted tooth had been completely removed and there was no evidence of a mandibular fracture (Fig. 2, left). Except for mild postsurgical edema and moderate pain which was easily controlled by codeine and acetylsalicylic acid, the postoperative course was uneventful. On the fourth day, the dressing was changed and the skin sutures removed. At the end of two weeks, because of the absence of edema or discharge and excellent union of the incision, dressings were discontinued.

At the end of six weeks, a fine pink linear scar, well hidden by the lower border of the mandible, was barely perceptible. A roentgenogram taken three years later revealed that most of the surgical defect had completely filled in with regenerated bone (Fig. 2, right).

MICROSCOPIC EXAMINATION—Microscopic examination of the section revealed a mature

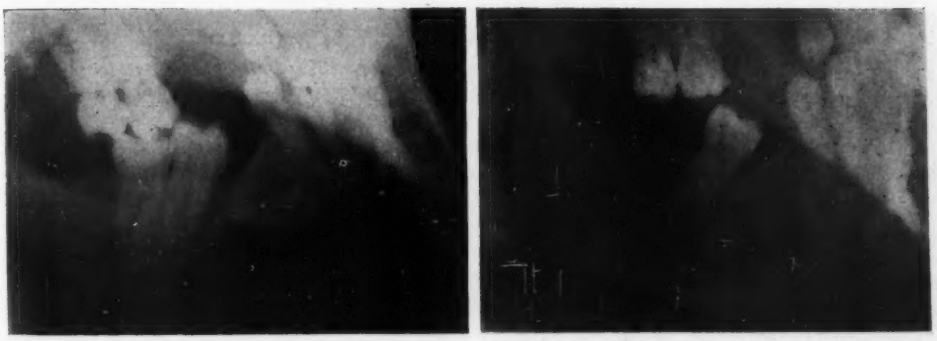


Fig. 2—Left: Immediate postoperative roentgenogram. Right: Roentgenogram taken three years later showing bone regeneration

fibrous connective stroma with collagen present at scattered sites. An inflammatory cellular exudate, rich in plasma cells and lymphocytes, had infiltrated the stroma (Fig. 3, left, A). Seeded deep within the stroma were epithelial structures which were arranged in irregular cords. The "palisading" of these cells gave the impression of similarity between these cells and early ameloblasts found in the enamel organ (Fig. 3, left, B). The inner margin of

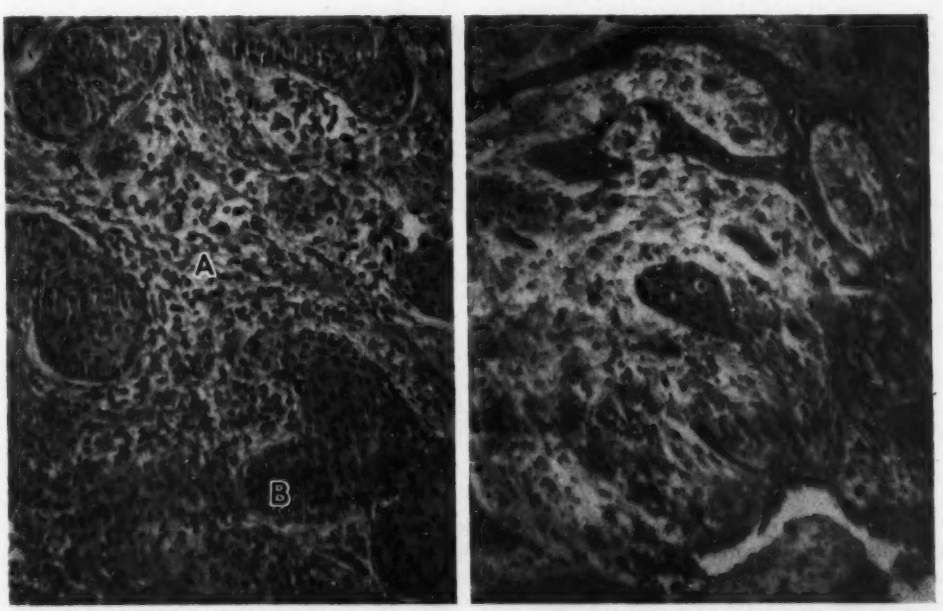


Fig. 3—Left: Low-power microscopic section revealing epithelial structures and inflammatory exudate within stroma. A, inflammatory cellular exudate. B, "palisading" of cells. Right: Low-power microscopic section revealing stratified squamous epithelium which lined cyst space

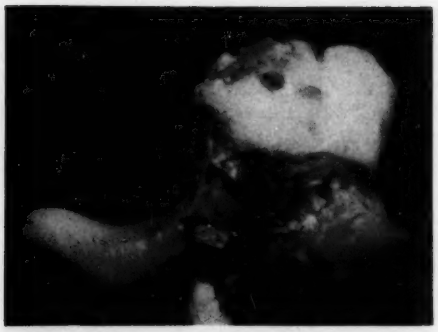


Fig. 4—Gross specimen of extracted tooth. Crown and root portion were rejoined with sticky wax for photographic purposes

the mass was lined with an irregular strip of stratified squamous epithelium which projected in fingerlike fashion into the adjacent stroma (Fig. 3, right). Vascularity was moderate and evidence of hemorrhage was seen throughout the section. The diagnosis was dentigerous cyst, with ameloblastomatous changes.

SUMMARY—A well developed 37 year old negro woman came for examination because of swelling of the tissues on the right side of the face and neck. An impacted anomalous molar tooth was found at the inferior border of the mandible on the right side. Because of the extreme inferior position of the tooth, an extraoral approach was employed for its removal. The crown of the impacted tooth exhibited what appeared to be internal resorption (Fig. 4).

The mass of soft tissue was attached to the crown and occupied space in the bone. It was removed and examined, and it proved to be an unusual type of dentigerous cyst in which ameloblastomatous changes were present.—*1060 Broad Street.*

■ Mark of Greatness

Greatness has always been a mark to aim at. In these rudderless days, when we are misguided by small and fumbling minds, it is not only inspiring but imperative to "think continually of those who were truly great." Soldiers on forgotten fields of battle, scientists in makeshift laboratories, stubborn idealists fighting to save a lost cause, teachers who would not be intimidated, tireless doctors, the anonymous army of dreamers and doers—all these by their very living fought for everyone. They sacrificed hours of ease for our casual comforts; they gave up safety for our security. Glorifying the heroic spirit of man, they added to our stature.—*Louis Untermeyer.*

Prevention of rheumatic fever and bacterial endocarditis

The American Heart Association recently has revised its recommendations for the prevention of subacute bacterial endocarditis. The full statement, entitled "Prevention of Rheumatic Fever and Bacterial Endocarditis Through Control of Streptococcal Infections," published in the February 1955 issue of *Circulation*, is available in leaflet form from the American Heart Association, 44 East Twenty-third Street, New York 10, N. Y. Section four of the statement deals specifically with prophylactic methods to be used by the dentist against bacterial endocarditis. Entitled "How the Dentist Can Protect His Patients Against Bacterial Endocarditis," the information is printed in chart form. The suggestions in this chart are substantially the same as those previously published by the Council on Dental Therapeutics of the American Dental Association and carried on page 65 of the 1955 edition of *Accepted Dental Remedies*. Drug combinations other than those suggested in the chart are available for this purpose, but the procedures described here are believed suitable for general use. Copies of the chart may be obtained from the American Heart Association or from any of its local offices. The text of the dental statement is as follows:

Penicillin—Penicillin is the drug of choice for administration to patients with rheumatic or congenital heart disease undergoing dental manipulations, or surgical procedures in the oral cavity. Although the exact dosage and duration of therapy are somewhat empirical, there is some evidence that for effective therapeutic prophylaxis reasonably high concentrations of penicillin must be present at the time of the surgical procedure. The dosage regimens employed for long-term prophylaxis of rheumatic fever are inadequate for this purpose. There is reason to believe that continuous maintenance of penicillin in the blood over a period of several days will result in the death of those organisms which have lodged in the heart valve during the period of transient bacteremia. Not only should penicillin prophylaxis be designed to afford maximum protection, but the method must also be practical. In general, the parenteral route of administration is preferred. All patients should be instructed to report to their physician or clinic should they develop a fever within a month following the operation.

Dosage—Six hundred thousand (600,000) units of aqueous penicillin and 600,000 units of procaine penicillin in oil containing 2 per cent aluminum monostearate administered intramuscularly 30 minutes before the surgical procedure.

As an alternative, although considered less desirable, penicillin may be administered by the oral route in dosages of 250,000 to 500,000 units one-half hour before each meal and at bedtime, beginning 24 hours prior to the operation and continuing for five days. At the time of the surgical procedure it is advisable to give an additional 250,000 units.

Contraindications—Patients who give a history of sensitivity to penicillin.

Other Antibiotics—The broad spectrum antibiotics should be employed as prophylaxis in patients who are sensitive to penicillin or in those who are undergoing surgery of the urinary or lower gastrointestinal tract. Oxytetracycline, chlortetracycline, or erythromycin should be administered in full dosage for five days, beginning treatment the day prior to the surgical procedure.

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The oral surgeon and nervous tension

THE INCREASED OCCURRENCE of cardiovascular accidents, hypertension, gastrointestinal disorders and nervous disabilities among oral surgeons is evidence of the tensions to which members of the profession are subject. The oral surgeon is exposed almost continually to considerable nervous tension. This is due primarily to the nature of his work and to the emotional stresses so often present in his patients. The majority of patients facing routine exodontic procedures experience varying degrees of apprehension. Even at best, some fears are present. Tensions of this type are easily transmitted to the operator, and they produce emotional stresses that give rise to various undesirable sequelae. It is imperative, therefore, that every oral surgeon look squarely at the problem and make every attempt to conduct his practice in such a fashion as to minimize these undesirable reactions in his patients and in himself.

Careful analysis of the problem reveals some of the important factors involved, the awareness of which will aid in the development of a sensible office policy, which in turn will help reduce the nervous tension, both of the patient and the surgeon.

An office staff that is kind, sympathetic and efficient is of prime importance. Small acts of kindness during the preoperative and operative periods are greatly appreciated by nervous patients, and they tend to allay their fears and soothe their apprehensions. Kindness and quiet unhurried efficiency are the most desirable combination for which office personnel should strive. Such a combination will pay high dividends and will add greatly to the composure both of the patient and the surgeon.

Adequate preoperative sedation usually produces a feeling of well being and, in turn, allows the patient to be cooperative and relaxed under general or local anesthesia. Intravenous barbiturate sedation has the added advantage of a more rapid onset and a shorter recovery time as compared with oral administration of the same dosage. It also allows the patient to become ambulatory shortly after completion of the operative procedure, which has its obvious benefits.

The choice of anesthetic agents and type of anesthesia should, of course, be made by the operator. General anesthesia is very popular, since a large number of patients desires to be free of consciousness of any phase of the operative procedure. General anesthesia, however, should not be considered as a universal solution, despite the fact that it is frequently the anesthetic of choice. Efficient local anesthesia combined with adequate preoperative sedation is an effective, safe combination that is becoming increasingly popular with surgeons and with patients. Some patients are fearful of losing consciousness, and others are rated as poor risks because of physical disabilities. The technical difficulty of a contemplated procedure may also exert a strong influence on the choice of anesthesia. It is important, therefore, for every oral surgeon to be well versed in all phases of patient management under either local or general anesthesia. To be poorly prepared in either situation invites apprehension and poor results.

To attempt to do more work than can be done deliberately and with composure is an invitation to bad operative habits, to hurry and to nervous tension. This, of course, involves the office personnel, the surgeon, and the patient. A wiser course is to develop a policy of achieving as much as is sensibly possible in each office visit and thereby reduce the number of return visits required by each patient. Efficient scheduling of appointments then will usually result in a maximum amount of work produced with a minimum of disruption and discord.

Frequent periods of recreation away from the usual professional routine are desirable and will result in increased efficiency, the breaking of tension habits, and in an improved health level. Although the temptation of increasing income by increasing working hours is great, it generally is a fallacious policy that probably will result in decreased returns eventually. Actually, hard work is not in itself harmful, but the tensions and exhaustion that frequently accompany such a practice produce harmful effects. Frequent short periods away from this routine are, therefore, desirable.

Nervous tension as seen in the oral surgeon and in his patient is a controllable health factor and is a by-product of present-day life. Usually, it cannot be eliminated completely, but by the development of an efficient program, it can be kept at a minimal level.—*Fred A. Henny.*

■ Correction In Recommended Dosage for Epinephrine Injection

The reader's attention is drawn to the "Clinical Observations" column on page 78 of the January 1955 issue of the Journal of Oral Surgery. The last paragraph of this page deals with the anaphylactic reactions of certain patients to the injection of penicillin. The dosage of epinephrine was stated incorrectly through a mechanical error and should read: "Immediate subcutaneous injection of 0.5 cc. of epinephrine (1:1,000) may be lifesaving."

In addition to the injection of epinephrine, injectable antihistamines may be of considerable benefit and therefore should be readily available.

■ The Policy and Budget Committee of the New York Heart Association has given approval to the publication of a report relative to the use of epinephrine in connection with procaine as a local anesthetic for dental procedures in patients with diseases of the heart and circulatory system. The substance of the report is as follows:

It is understood that it is common dental practice to use epinephrine in dilutions of 1:50,000 (never more concentrated). Rarely more than 2.0 cc. of solution is used in any one session. Epinephrine is combined with procaine, one of whose pharmacologic properties is to counteract the tendency of epinephrine to cause cardiac irregularities.

The dentist should have information from the attending physician as to the nature of the heart disease and the medication the patient is receiving. Certain medicaments used in cardiac disease increase the activity of epinephrine, and if when the patient is under emotional stress cardiac disturbances are noted, these signs and symptoms might wrongly be attributed to epinephrine.

Under these conditions and with these precautions, the use of epinephrine with procaine for dental surgery presents no special hazards in persons with heart disease. It is recommended that for any one session there be used no more than 10.0 cc. of 1:50,000 epinephrine—no more than 0.2 mg. of epinephrine in any form.

All too frequently a well meaning, but uninformed physician, advises an epinephrine-free local anesthetic for the patient with heart disease. Little consideration is given to the type and extent of the procedure or the patient's true cardiac reserve capacity. As a result, the patient frequently receives anesthesia of such short duration that surgical procedures are accompanied by pain. Pain during an oral surgical procedure on a cardiac patient may precipitate dangerous sequelae and defeat all of the carefully executed preoperative measures that have been carried out.

The authoritative report of the New York Heart Association should prove invaluable to the dentist using local anesthetics, although further clinical investigation on patients with heart disease is indicated.

The introduction of profound local anesthetics has permitted the use of a smaller epinephrine content, and adequate anesthesia can be obtained with little or no deleterious effect. A greater volume of solution may thereby be utilized with a relatively wide margin of safety. It must be borne in mind constantly that elimination or decrease of epinephrine in the anesthetic solution is not a substitute for the control of anxiety through reassurance and a confident, cheerful and sympathetic attitude on the part of the surgeon. Of equal importance is the execution of all phases of the procedure in a carefully planned, precise, dexterous manner, exercising the highest degree of judgment with full consideration given to all of the factors involved.

■ The introduction of trypsin into clinical use has made available an adjunct in the treatment of local inflammation and associated edema. Trypsin has been used topically in various types of wounds to débride necrotic tissues by proteolytic action and thus promote healing. Solutions of trypsin have been injected into cavities to lyse viscous exudates and have been used as inhalants to liquefy tenacious mucus.

Clinical investigators, taking advantage of the proteolytic effects of trypsin, used this function to break down blood clots and observed a decrease in the swelling and pain accompanying thrombophlebitis. Further studies and observations confirmed the safety and efficacy of intramuscular trypsin in the treatment of a wide variety of acute inflammatory disorders. Although principally utilized for relief of sepsis and symptoms of acute thrombophlebitis and phlebothrombosis, the drug appears to have a good potential in the management of acute inflammatory conditions associated with oral disease.

In the cases in which infection is present and antibiotics are being used, trypsin may be added as adjuvant therapy. Although there is no suggestion that trypsin has an antibacterial effect, the speed at which patients improve is much greater than when the antibiotic is used alone.

A suspension of crystalline trypsin in sesame oil (Parenzyme), each cubic centimeter containing 5 mg. of trypsin, is ingested by the intramuscular route. A dose of 2.5 mg. to 5.0 mg. (0.5 cc. to 1.0 cc.) is injected deep intramuscularly in the buttocks every 6 to 8 hours daily for 3 to 8 days. Single daily injections appear efficacious.

No toxic reactions have been reported. Mild pain and induration at the site of injection have been reported in 5 per cent to 15 per cent of the patients. At the present time, drug incompatibility is unknown. This treatment should be used cautiously in patients with blood clotting abnormalities, with impaired liver or kidney function, with acute pancreatitis or with hemorrhagic states. Patients with known sensitivity to parenterally injected oil should be observed closely. To date the drug has had very limited use in oral surgery, and further investigation is needed to determine its value in this regard.

■ Examination of the eyes is important in evaluating a patient who has sustained severe maxillofacial injury with possible intercurrent intracranial damage. The pupils should be examined for their reaction to light and accommodation, and failure of the pupils to react is indicative of significant head injury. Bilaterally fixed and widely dilated pupils suggest a grave prognosis for life. Unilateral dilation and fixation of a pupil indicates the side of the head sustaining the intracranial injury. Neurosurgical consultation in such instances is imperative. Diplopia is associated with zygomaticomaxillary fractures with destruction of the orbital floor and downward displacement of the bulb of the eye. Spontaneous regression of diplopia can be anticipated after adequate reduction of bony fragments, although the process may be delayed by intraorbital edema or hematoma.

■ Meperidine hydrochloride (Demerol) administered by intermittent slow intravenous injections or intravenous drugs produces analgesia and relaxes smooth muscles, thereby decreasing the possibility of laryngospasm during intubation. Meperidine hydrochloride may also reduce the amount of general anesthetic needed and makes for a smoother anesthetic course. Return to consciousness is more rapid and postoperative pain is delayed. Large doses, particularly when administered rapidly, may produce prolonged apnea. Meperidine hydrochloride administered intravenously in conjunction with thiopental sodium should not exceed 25 mg. in any one 15 minute period in order that sufficient time be given to observe its effect. Facilities for adequate oxygenation, assisted respiration and controlled respiration must always be available if meperidine hydrochloride is to be used intravenously. Nalorphine (Nalline) hydrochloride (5 to 40 mg.) also should be available as an antidote against respiratory depression, which may result from overdosage or unusual sensitivity to the drug.

■ Removal of Torus from Palate

Q.—What is the prognosis for a region of the palate from which a large torus has been removed?

A.—These benign exostoses are not known to recur after removal. Except for a slight scar in the region of the excision, the zone will be entirely normal.

■ Tetracycline and Gastroenteric Disturbances

Q.—Does tetracycline (Achromycin, Tetracyn) have any advantage over the other antibiotics?

A.—Tetracycline, a relative newcomer to the group of broad-spectrum antibiotics, has been given much consideration because it has been reported to induce in patients fewer side effects than chlortetracycline (Aureomycin), and oxytetracycline (Terramycin). Tetracycline, however, is not entirely free from side effects. On investigation, disturbances of the gastroenteric tract were noted in about 5 per cent of normal men who took the drug.

Nausea, vomiting and diarrhea can be reduced considerably in a patient receiving one of the broad-spectrum antibiotics by mouth if such a drug is taken after a meal or in conjunction with yogurt, buttermilk, milk, sodium carboxymethylcellulose or possibly with an extract of Coca-Cola. Supplementary administration of vitamin B is indicated whenever a dose of 2 Gm. of any of these drugs is given for more than five days.

■ Cervical Lymphadenopathy

Q.—I have a patient with an isolated enlarged cervical lymph node, present without significant change for approximately three weeks. The patient is otherwise asymptomatic, and oral pathologic conditions are not obvious. What steps should be followed?

A.—This condition justifies careful and detailed investigation. Complete blood studies and otorhinolaryngological consultation is imperative. Nasopharyngeal carcinomas may be insidious and asymptomatic until cervical metastasis occurs. If blood studies do not aid in establishing a diagnosis, removal of the gland for histopathologic examination is definitely indicated. Although the lymphadenopathy may be purely inflammatory, the possibility of Hodgkin's disease, lymphosarcoma or other malignancies must be considered.

■ Tic Douloureux

Q.—What is the modern concept of the treatment of tic douloureux?

A.—The most significant recent contribution to the management of this disease is the development of the so-called "decompression operation" described first by Taarnhoj. The principle of this procedure is the enlargement of the dura at the point where the fifth nerve passes from the posterior to the middle fossa. The procedure has not been done over a sufficient period of time to evaluate accurately the permanency of the treatment, but, to date, excellent results have been reported. The principal advantage of this operation is the relief of symptoms without the associated postoperative anesthesia that occurs with retrogasserian neurectomy of the posterior sensor root.

Alcohol injection and peripheral neurectomy is advocated in the early course of the disease and when the disease is confined to one branch. Patients debilitated from long standing symptoms may tolerate the major procedure with

less untoward effect if temporary relief is afforded by injection or peripheral neurectomy. This procedure permits a sufficient period of time for adequate dietary intake and preoperative preparation for the decompression or rhizotomy operations.

Medical trichloroethylene inhalations, protamide and vitamin B_{12} are frequently used with variable results. Vitamin B_{12} in doses of 1,000 micrograms intramuscularly daily for one week and then 100 micrograms every other day for two weeks has been reported to be of definite therapeutic value.

■ Antibiotics as Lozenges

Q.—What antibiotics are useful topically in the form of a troche or lozenge in combating oral infection?

A.—In considering any type of antibiotic therapy, it is well to keep in mind that no antibiotic can be effective in bringing an infection under control unless the offending microorganism is sensitive to the antibiotic used.

The use of penicillin in any form or combination with other drugs as a lozenge is definitely contraindicated because of the possible local reactions and potential sensitization of the patient to this drug. Tyrothricin, also, although restricted to topical use, is not generally recommended for use as a troche or lozenge.

The drugs that appear to have definite value for use as a lozenge without side effects are bacitracin, neomycin and polymixin B. It has been reported that erythromycin and carbomycin have been used to advantage locally.

■ Paralysis of Lower Lip

Q.—I have a patient with unilateral paralysis of the lower lip. Is there any treatment to improve this cosmetic deformity?

A.—Unilateral paralysis of the depressor muscles of the lower lip has been improved by an effective and simple procedure advocated by Hector Marino (Surg., Gynec. & Obst. 96:433 April 1953). A small incision is made at the angle of the mandible on the unaffected side, and a portion of the ramus marginalis mandibulae of the facial nerve is excised. The procedure is controlled by electrical investigation. The results reported were uniformly good. The patients did not complain of the moderate reduction in size of the oral aperture.

■ Barbiturate in Coronary Disease

Q.—Is there any danger in heavy premedication of barbiturates when the patient has had a coronary thrombosis?

A.—Barbiturates are excellent medication to allay apprehension preoperatively. Their use, however, should be limited carefully in the patient who has coronary disease. These drugs in large amounts may reduce blood pressure and if the caliber of the coronary artery has been noticeably decreased, the pressure may be insufficient to oxygenate the heart adequately if the demand for blood to the heart should increase. Myocardial infarction may ensue.

Carefully controlled medication, assurance to the patient, confidence on the part of the operator and painless, quickly executed short procedures are requisites in the management of the patient with coronary disease.

■ Removal of Deciduous Cuspids

Q.—When is it advisable to remove the deciduous lower cuspids to allow for eruption of the permanent cuspids or for alignment of the permanent incisor teeth?

A.—It is usually poor judgment to remove the deciduous cuspids solely for the purpose of improving alignment of the incisors unless the patient is under treatment or careful control of an orthodontist and a long range orthodontic program is contemplated. The appearance of abnormal recession of the gingiva of the erupting permanent incisors indicates the necessity for treatment, and under such conditions removal of the deciduous cuspids may become necessary.

■ ORAL SURGERY. By Sterling V. Mead, D.D.S. Fourth edition. 1,478 pages with 872 illustrations and 13 color plates. Index. Price $25. St. Louis, C. V. Mosby Co., 1954.

This completely rewritten work is an excellent general text for the undergraduate student of oral surgery and is in many ways a good reference work for the graduate student and practicing oral surgeon.

Most of the 35 chapters are generously illustrated with both photographs and drawings. The latter are well done and present their subject matter in a clear concise fashion.

Chapter 3, "Surgical Procedures," presents many of the basic concepts of surgical procedures especially as applied to exodontics and minor oral surgery. Chapter 4, "Surgical Anatomic Relationships of the Mouth," is especially well done. The illustrations bring out the pertinent points of anatomy. The chapter makes an excellent reference for head, jaw and upper neck anatomy.

A good general discussion of the antibiotics and chemotherapeutic agents is given in Chapter 6. The chapter's only weakness lies in the fact that several antibiotic agents currently in use are not included in the discussion, although the most important and most frequently utilized ones are.

The chapter on removal of teeth covers the subject well, both in the text and in the diagrammatic illustrations. The discussion of the removal of impacted teeth is good but ignores the use of bone drills. The importance of local anesthesia in the alleviation of postoperative pain is overemphasized in the light of present day drugs and technics.

The closed and open methods of treatment of fractures of the mandible is well covered with the exception of fractures of the mandibular condyle. More discussion of open methods of surgery for reduction of fractures of the facial bones also would add to the value of the chapter.

Chapter 30 is one of the outstanding portions of the text and covers in clear, concise detail, the important problems of syncope, shock, collapse and emergency measures. All possible emergency states are described and treatment outlined. Treatment includes that obtained by medication as well as the important mechanical and operative procedures. Tracheotomy is explained, and the illustrations of this subject are simple and clear.

Oral Surgery is a valuable addition to the professional library.

■ THE MEANING OF SOCIAL MEDICINE. By Iago Galdston, M.D. 137 pages. Index. Price $2.75. Cambridge, Mass., Harvard University Press, 1954.

The author does an excellent job of defining what he means by "social medicine" in his first chapter. After the first chapter's well-documented discussion, the author goes on to a challenging presentation of the "failure" of modern medicine, giving the exact way in which the "failure" has occurred. This "failure," incidentally, is not only that of the present but is related to various events in the past. The author discusses particularly some of the vicissitudes faced by Pasteur, who was not a physician.

In the third and fourth chapters, the activities of medicine in the areas of etiology and epidemiology in the struggle against diseases are reviewed, the author pointing out what he considers are essential divergences of these activities from pure social medicine. Next, Dr. Galdston points out that, in converting mortality into morbidity in the case of numerous diseases that once were potent death-dealers, medicine has actually gotten itself into more trouble, because of the lag in acceptance of social medicine concepts with which to solve pressing health problems.

How the integration of social medicine

education into the framework of general medical education can best be accomplished is considered in a somewhat briefer chapter, but its brevity is compensated for by the excellence of the evaluation and the practical suggestions on procedure. Every dentist, as well as physician, will find this volume of much interest. —*W. W. Bolton.*

■ ARREST OF BLEEDING. PHYSIOLOGY, PHARMACOLOGY, PATHOLOGY. By Jacques Roskam, M.D. 71 pages. Price $2.75. Springfield, Ill., Charles C Thomas, 1954.

This monograph discusses the results of an entirely new approach to the problem of bleeding. Having observed that the average bleeding time is a constant measurement in a patient under standardized conditions, the author devised a statistical method to study spontaneous hemostasis in experimental animals and man. With the help of this method, it is shown that Cannon's views about the maintenance of blood in mammals are not entirely correct.

The paradoxical effects of epinephrine as well as of many anesthetics on the bleeding time are explained. The hemostatic action of thrombin is discussed. Experiments with heparin give new proofs that prolonged bleeding times depend on the combined action of at least two hemorrhagic factors, one vascular, the other some disorder of the blood itself.

Applied to pharmacological problems, the new method discloses that vasoconstrictor substances and coagulants do not *ipso facto* shorten the bleeding time. Some of these drugs even prolong it in a significant way. Other drugs with the same fundamental properties favor the arrest of hemorrhage. Consequently, the latter group only may be termed hemostatic. Other hemostatics seem to reduce the bleeding time by their quinonic functions even if they are neither vasoconstrictors nor coagulants. Among new hemostatics thus discovered is adrenochrome, a product of the oxidation of epinephrine, which may be considered a physiological hemostatic.

The new method for studying spontaneous hemostasis has important consequences in therapeutics. It shows that a number of treatment methods must be discarded; among them the widespread use of cold, heat and bloodletting in the treatment of bleeding. However, preventive and curative treatments do result from pharmacological researches on bleeding time. These general treatments, as opposed to topical ones, are particularly intended for the hemorrhages which cannot be specifically or locally treated.—*I. Newton Kugelmass, M.D.*

■ ANOMALIES DENTO-CRANIO-FACIALES. By Maurice Lepoivre. 127 pages with 85 illustrations. Index. Price 860 F. Paris, Masson & Co., 1954.

The problem of abnormalities and their hereditary nature has attracted attention for many years. The old concepts have been replaced by new theories founded on scientific research. A new science called genetics has been born. Unfortunately, to date, satisfactory progress has not been made. Too many problems remain unsolved.

After many years of research, Dr. Lepoivre takes this opportunity to explain the etiology of malformation and deformation of the dento-cranial-facial system. He discusses the growth of facial bones and teeth and the development of occlusion. The book covers the period of organogenesis—fecundation up to the third month of the intra-uterine life—and the period of morphogenesis, from the third month of the intra-uterine life to adult age. Growth continues after birth, the only change being the environment.

Among the many etiologic factors mentioned, Dr. Lepoivre includes the effects of the roentgen ray and radium, virus infections, endocrine glands and the lack of vitamins such as vitamin B-2 in the formation of the cleft palate. He supports his explanation with case histories and experimental data.

The further study of organogenesis and morphogenesis in genetics may help solve many problems. This book is highly recommended to all orthodontists and dentists interested in maxillofacial development and deformation.—*Hratch Abrahamian.*

■ THE PHYSICIAN IN ATOMIC DEFENSE. By Thad P. Sears, M.D. 308 pages with 53 illustrations. Index. Price $6. Chicago, The Year Book Publishers, 1953.

This book is written for the purpose of instructing the physician in the nature of atomic energy and the effects it may produce on the body. The author has condensed a vast amount of information concerning the various forms of radiation and atomic energy, in both war and peace.

He points out that in caring for victims of an atomic bomb attack dentists will be greatly needed and should have some preliminary training in first aid and emergency medical casualty care.

A discussion of atomic structure and the influence of radioactivity is followed by a description of isotopes, their methods of manufacture and their application to medical practice.

The author then outlines the nature of atomic bomb injuries and various types of protective therapy.

Final chapters cover methods of mass casualty care. As the number of physicians and nurses will be too few to care for the thousands of casualties following an atomic attack, the author points out that there will be need for auxiliary medical workers. These workers, he says, should be trained now.—*Russell W. Bunting.*

■ FUNDAMENTALS OF ANESTHESIA. Prepared under the editorial direction of the Consultant Committee for Revision of Fundamentals of Anesthesia, Council on Pharmacy and Chemistry, American Medical Association. Third edition. 279 pages with 89 illustrations and 19 tables. Index. Appendix. Price $6. Philadelphia, W. B. Saunders Co., 1954.

This book is an excellent reference manual for students of anesthesia. It presents in outline form a compact but comprehensive review of a broad subject. It describes (1) the basic principles of the physiology, pharmacology, chemistry and physics on which the sound practice of anesthesiology is based, (2) the technical procedures necessary to apply these principles effectively in relieving surgical pain and (3) the application of these principles to the management of patients suffering from injury, illness, operation or effects of depressant drugs.

As a result of its brevity, the text emphasizes fundamentals at the expense of details. The result is that beginners will find it rather difficult to follow certain phases of the matter without the aid of a standard modern textbook for purposes of elaboration.

A wealth of current knowledge, vital to the understanding of and successful administration of anesthesia, has been painstakingly and lucidly condensed into one compact volume. The description of technics for laryngoscopy and endotracheal intubation and the discussion of laryngospasm deserve special mention. Although the chapter on regional (conduction) anesthesia is extensive, it neglects to consider nerve blocks used in oral and maxillofacial surgery.

This text is recommended as a valuable adjunct for those who are interested in the study and practical application of anesthesia.—*James Springer.*

■ STEDMAN'S MEDICAL DICTIONARY. Edited by Norman Burke Taylor, M.D., in collaboration with Lieut. Col. Allen Ellsworth Taylor, M.A. Eighteenth edition. 1,561 pages with 622 illustrations. Appendix. Price $11.50. Baltimore, Williams & Wilkins Co., 1953.

The eighteenth edition of this well-known medical dictionary has an enlarged format and an increase of 200 pages over the preceding edition. Much of the increase is accounted for by the addition of hundreds of new definitions relating to recent developments in the medical sciences. Some obsolete terms have been deleted, and many definitions have been revised or expanded. Meaning, pronunciation, and derivation are given for every word. Terms used in dentistry, chemistry, veterinary medicine and other health sciences are included.

Various added or improved features facilitate the use of this edition. Several hundred

new text figures, most of them original drawings, illustrate definitions. Anatomical tables listing arteries, muscles and nerves appear in their alphabetical place through the dictionary. Entries for anatomical terms have been translated from the former Latin forms and are now presented in their English equivalents in the tables. The history of medicine is not neglected. Brief biographical sketches of leading figures in medical history are provided.

One of the most interesting sections of the dictionary is a valuable article on medical etymology, which contains a detailed root-word list. Comments are included on the careless formation of hybrid words which combine elements from different languages. Those who are discriminating in language will enjoy the article; others need it.

Despite the interest of the editors in word formation, dental specialties appear to be listed entirely with the less exact suffix *ia*—orthodontia—rather than the more accurate and currently approved ending *ics*—orthodontics. Perhaps an authority on dental nomenclature should be considered for inclusion in the work on future editions.

On the whole this edition continues the scholarly character and high standard long associated with *Stedman's Medical Dictionary*.—*Ida Marian Robinson.*

■ THE PHYSICS OF RADIATION THERAPY. By Harold Elford Johns, Ph.D. 286 pages with 137 figures and 36 tables. Index. Appendix. Price $8.50. Springfield, Ill., Charles C Thomas Co., 1953.

This book is part of the American Lecture Series on Radiation Therapy. The author is professor of physics at the University of Saskatchewan, Canada. The book includes an authoritative presentation of such subjects as the structure of matter, the physics of radiation, the production and properties of roentgen ray, their measurement and quality. Its principal contributions are in the explanation of the interaction of roentgen rays with a scattering medium such as occurs when deep roentgenotherapy is administered to a patient.

As a result of absorption and scatter of roentgen rays, the dose delivered at different depths in a patient varies considerably. Measurements of the dose are presented in graphs of isodose curves.

Such considerations in dental roentgenography are only beginning to be presented (for example, by E. Dale Trout) in discussions of the relation of scattered radiation to whole body exposure of the dental x-ray operator. The usual publication on hazards to the dental operator considers only one dimension; that is, the straight line dimension. The addition of isodose curves to this consideration adds the remaining two dimensions of space and will enable dentists to understand the complete hazards in all portions of the dental office.

Consideration is given also to the calculation of dosage for the special case of whole body irradiation. Radiation dosage is presented for therapy from radium and high energy devices such as the cyclotron, betatron, synchrotron, neutron sources, Van De Graaff generator and sources of artificial radioactivity such as cobalt 60. Methods are given for the calculation of radiation dose from radioisotopes introduced internally.—*William Ward Wainwright.*

DIE ERKRANKUNGEN DER SPEICHELDRÜSEN. By Hermann Mathis, Prof. Dr. med. 90 pages with 58 illustrations. Index. Price 92 DM. Muenchen, Germany, Carl Hanser, 1954.

This monograph deals with the diseases of the salivary glands. The author starts with an evaluation of sialography and supports his fine description with clear illustrations.

One chapter is devoted to the physiological and pathological activity of the glands. The author describes the pathology of these organs and includes a discussion of clinical cases. One reads with interest the theory, clinical considerations and therapy associated with these pathological conditions.

The book is well written and covers the international literature. It is a fine addition to the literature of the diseased salivary glands.—*Eugene Schorr.*

■ The Rationale for Velar Closure as a Primary Procedure in the Repair of Cleft Palate Defects. Wayne B. Slaughter, M.D., D.D.S., and Samuel Pruzansky, D.D.S., M.S. Plast. & Reconstruct. Surg. 13:341 May 1954.

In the past, repair of clefts of the palate has been based on the assumption that the problem was only that of closing a defect or hole in the structures involved. Little or no consideration was given to the growth potential of the bony framework around the defect or to the dynamics of the adjacent muscular structures.

In view of the wide range of individual variation of the defect, the surgical procedure must be altered to fit the particular case, both in terms of time and technic.

Four cases are presented which explain closure of defects of the velum and the relationship of this closure to the closure of the entire cleft of the palate. These cases demonstrate the muscular forces present in the region and the part they play in the configuration of the defect as shown at birth.

Re-establishment of the delicately balanced muscle masses of the velopharyngeal region forms the basis for the anatomical and functional correction of this defect.—*Irwin Small.*

■ Clinical Experience in the Treatment of Hemangiomata. Varaztad H. Kazanjian, M.D., and Aram Roopinian, M.D. Plast & Reconstruct. Surg. 13:325 May 1954.

There is no satisfactory conservative therapy for eliminating extensive capillary hemangiomas. In fact, the use of cosmetics to conceal such lesions was more satisfactory than surgery, radiation, destruction by carbon dioxide snow, tattooing and other methods. However, in certain selected cases, depending on the size of the lesion, its configuration, the area involved and other factors, surgery was used advantageously.

In adult patients with venous hemangiomas (strawberry marks), surgery was the method of choice. Repair was effected by pedicled flaps from the surrounding healthy skin or by skin grafts, and rarely by flaps transferred from distant areas. In children radiation was successful in reducing the lesion to varying degrees, but late surgery was almost always necessary to correct the resulting surface deformity.

In adults, localized cavernous hemangiomas were always treated by surgery. In diffuse types, roentgenotherapy, sclerosing solutions or electrocoagulation were used to reduce the lesions and make future surgical procedures more simple.—*Irwin Small.*

■ The Error of Gustav Passavant. James Calnan. Plast. & Reconstruct. Surg. 13:275 April 1954.

Passavant's theory of velopharyngeal closure has been accepted without question for nearly a century. Until the middle of the nineteenth century the soft palate was considered to be purely a flap valve to close off the nasal pharynx. There was no clear conception of its function until Passavant's classical paper in 1869.

Passavant stated, "This [bulging of the superior constrictor], accompanied by the raising and pushing back of the velum causes the closing of the palate-flap which is essential for intelligible speech . . . There are then, in my opinion, two ways in which the palate closes: the first is necessary for speech and is caused by the activity of the Levatores palati and the upper pharynx constrictor or rather perhaps, the part of this muscle known as pterygo or pharyngeus, arising from the hamulus; the second is that occurring in swallowing, choking, vomiting, etc. Here the closing is further strengthened by the contraction of the pharyngo palatini."

The objections to Passavant's theory are:

It is inconsistent. Passavant observed this

muscular ridge on the posterior pharyngeal wall in the normal patient by the use of a postnasal mirror, but failed to explain why the ridge could be observed in only one of 50 patients. Phonation with a postnasal mirror *in situ* can hardly be considered a normal position for speech; it must have been difficult to prevent a gagging reflex, and this surely is what he recorded.

It is uneconomical. It would seem to be uneconomical for there to be a muscular ridge on the posterior wall, if the velum alone can reach that wall and occlude the nasopharynx during speech.

The ridge is too low. Passavant must have noted the level at which this muscular ridge on the posterior pharyngeal wall occurs, namely, at the level of the arch of the atlas. A normal palate elevates to a level above the height of the atlas. Thus Passavant's ridge is too low to play an active and important part during speech. In addition, there are no muscle fibers of the constrictor muscle above the level of the arch of the atlas; an aponeurosis provides the muscle with its attachment to the pharyngeal tubercle.

The contraction is too slow. The relatively slow contraction and relaxation of the ridge (the stage of contraction lasts invariably for more than one to two seconds) contrasts sharply with the rapid movements of the velum which are in the order of one movement in 0.1 to 0.01 seconds.

Its fatiguability. Passavant's ridge can be fatigued in the same way that swallowing can be fatigued. All this contrasts with the effortlessness of normal rapid speech in which it is possible to speak at a rate of more than 60 words a minute for several hours.

Hence, it must be deduced that Passavant's ridge is not essential for speech.—*Irwin Small.*

■ Freeze-Dried Bank Bone and Its Application in Clinical Oral Surgery. C. H. Blackstone. Mil. Surgeon 114:437 June 1954.

The bank bone is prepared at the National Naval Medical Center by freezing the bone and drying it under high vacuum. The resultant bone is porous with a friable spongelike structure and can be stored at room temperature in vacuum bottles. This bone can be used (1) to restore continuity where mandibular bone has been lost, (2) to restore contour and fill defects produced by surgery, and (3) to fill defects created by the removal of unerupted third molars.

In 20 cases where freeze-dried bank bone was used, only two failures occurred, and these were ascribed to faulty surgical procedures rather than to the material used.

The advantages of this procedure over fresh autografts are a decrease in operating time, less postoperative discomfort and less nursing care. The postoperative course in all the cases has been uneventful. This is a preliminary report; further studies of the physiology and histology of such bone repair are under way.—*Charles W. Freeman.*

■ Distant Metastasis from Carcinoma of the Oral Cavity. S. Gordon Castigliano and C. Jules Rominger. Am. J. Roentgenol. 71:997 June 1954.

The problem and significance of distant metastasis from malignant lesions primary in the oral cavity were studied through an analysis of 752 cases of oral malignancy. Cases of distant metastasis should be reported on the basis of total experience rather than on autopsy experience. By so doing a clear conception of the small part that distant metastasis plays in the problem of oral malignancy can be obtained.

The accuracy of clinical diagnosis of visceral metastasis may be as high as 80 per cent when diagnostic aids, including roentgenograms of the lungs and bones and laboratory studies, are properly used.

The cases studied were divided into two groups according to the periods in which the patients died; the first period covered 1930 to 1943, the second 1943 to 1951. This division was made largely because of radical changes in cancer therapy that occurred around 1943. With the development of improved irradiation procedures, the salvage rate and the amount of

long term palliation have been increased. These changes are significant as patients surviving a longer period of time have a greater opportunity to develop visceral metastasis.

In the group analyzed, of 200 patients known to have died of cancer of the oral cavity from 1930 to 1943, only 2 per cent presented evidence of distant metastasis, whereas of 121 patients known to have died from cancer in the period from 1943 to 1951, 10.7 per cent presented evidence of distant metastasis.

Visceral metastasis involved the lungs, bones, liver, brain, skin, muscles, heart, kidneys and small intestine. In spite of the increase in the incidence of visceral metastasis associated with oral malignancy, distant metastasis is still not as serious a problem in oral cancer as in other forms of cancer such as those of the breast, stomach and rectum, the incidence being much lower and the onset much later. Survey roentgenograms of the lungs and bones prior to radical surgery for advanced primary and secondary disease are advisable. The cure of oral malignancy requires control of the local disease and its regional metastatic spread.—*E. C. Hinds.*

■ THE ATTACHMENT OF THE MUSCLES OF MASTICATION. N.B.B. Symons. Brit. D.J. 96:76 Feb. 16, 1954.

During skeletal growth, considerable adjustment occurs in the attachment of the muscles of mastication. Little attention has been paid to this fact.

Classified according to their attachments, muscles are of two groups: (a) fleshy attachments, easily stripped from the bones and attached solely to the fibrous layer of the periosteum and (b) tendinous attachments, which are difficult to remove from the bone without surface destruction of bone.

The method by which shifting of the attachments is accomplished in Group a muscles was discussed as early as 1861. The method of shifting of the attachment in Group b muscles is less clear. Human fetuses of more than three months provided the source material for this study.

A study of the lateral pterygoid muscles, suprahyoid muscles, and temporal and medial pterygoid muscles indicates that continual adjustments must be made to the attachments of these muscles during skeletal growth. When the attachments are tendinous, there must be a continual process of breaking down and restoration.

It is possible that bone resorption and bone deposition are the means by which these adjustments are made during the period of growth.—*Donovan W. Brown.*

■ THE STRUCTURE AND FUNCTION OF THE MANDIBULAR JOINT. Leonard A. Rees. Brit. D.J. 96:125 March 16, 1954.

Examination of 19 fresh human mandibular joints was made by various anatomical and roentgenological technics to determine the type and degree of movement in the two compartments of the joint.

The meniscus consists of four transverse ellipsoidal segments: an anterior band, an intermediate zone, a posterior band and a bilaminar region, consisting of a stretchable temporal attachment and a nonstretchable condylar attachment. In front of the anterior band the upper joint cavity extends for a small distance. Behind this anterior extension the meniscus forms a visorlike cap to the condyle.

During function there is an eccentric hinge movement combined with some gliding in the lower compartment. In the upper compartment the meniscus slides forward on the articular eminence to the extent permitted by the degree of stretching of the bilaminar region and its temporal attachment. The potential spaces behind the meniscus and condyle appear to be occupied by soft tissues drawn in from the posterolateral aspect of the joint.

Opening and closing of the mouth occurs in six phases: (1) occlusal position, (2) retruded opening, (3) protrusive opening, (4) extreme protrusive opening, (5) closing and (6) retrusive closing. In the extreme protrusive opening phase when the meniscus has been drawn forward to its fullest extent, a "click-

ing" sound may occur as the condylar ridge slips forward over the anterior band of the meniscus.

The meniscus is not homogeneous in structure. Different parts of the meniscus are interposed between the condyle and the temporal bone in different positions of the mandible. The attachments and the structure of the meniscus allow it a considerable range of movement relative to the temporal bone during mandibular function.—*James Springer.*

■ Effect of Non-Volatile Substances on Salivary Glands in Sialography. Casper M. Epstein, M.D., D.D.S., and Richard Bendix, M.D. Plast. & Reconstruct. Surg. 13:299 April 1954.

Roentgenographic visualization of the salivary glands with opaque media is a diagnostic tool which may aid in the demonstration of calculi, foreign bodies, stricture, diverticula, neoplasms, inflammations within the glands and the relationship of these glands to the surrounding structures. Occasionally, a gland suspected to be diseased reveals no pathological manifestations when visualized by this procedure. The clinical observations, however, may indicate removal of the gland. On microscopic examination of the specimen, necrosis is often seen.

The possibility that these changes might be produced by the medium injected for the visualization was studied by injecting the submandibular salivary glands of ten normal dogs with various nonvolatile substances. The media used were: sesame oil, mineral oil, mineral oil emulsion, cottonseed oil, poppy-seed oil, peanut oil, olive oil, oil of theobromine and methiodal sodium.

Poppy-seed oil (vehicle of Lipiodol) produced considerable enlargement of the gland with obliteration of many ducts. Sesame oil and peanut oil produced foreign body reactions as did emulsion of mineral oil and oil of theobromine. Fibrosis was produced only with sesame oil and oil of theobromine. Minimal reactions were produced by olive oil, mineral oil, cottonseed oil, glycerin and methiodal sodium.—*Irwin Small.*

■ Why Surgical Repairs of Cleft Palate Fail. Orion H. Stuteville. Am. J. Surg. 87:660 May 1954.

That failures occur in the surgical closure of cleft palates is evident from the lack of agreement on procedures and on the age at which closures are to be performed. Failures are due to (1) breakdown in the suture line (surgical failure), (2) excessive scar formation, resulting in a poorly functioning soft palate which causes a speech defect even though the palate has sufficient length, and (3) short palate, resulting in the inability to close off the nasal pharynx.

The incision breaks down as a result of too much tension on the suture line at the time of closure; interference with circulation to the flaps, causing the tissue at the suture line to become necrotic; tension placed on the suture line by the tongue and muscles of the palate; a decrease in healing produced by the poor general condition of the patient, and infection.

Scar tissue is produced by the healing of the surgical incision. Therefore, the less trauma which occurs to the tissue during the repair, the smaller the scar. There is, however, variation in the amount of scarring produced by a given procedure. It has been well established that the interference with growth is directly proportional to the scar tissue formation.

In a high percentage of the patients, there is insufficient tissue of the soft palate to close the nasopharynx. Additional procedure is required to lengthen the soft palate. Some provision must be made for closure of the nasopharynx during function.

Surgical procedures on the palate may retard the growth of the middle one third of the face and as a result there is a gradual shift of the care of the cleft palate patient to a group management procedure in which the pediatrician, maxillofacial surgeon, otolaryngologist, pedodontist, orthodontist, prosthodontist, speech therapist and psychiatrist all cooperate. From these groups in which the patients are observed until maturity should come the answers to many of the problems that have arisen since the first successful surgical closure of a cleft palate. —*Myron Kaufman.*

Announcements

■ American Society of Oral Surgeons to Meet In October

The American Society of Oral Surgeons will meet October 12-15 in Los Angeles. Harry M. Seldin is president of the group.

■ Daniel F. Lynch Heads Oral Surgery Committee

Daniel F. Lynch, president of the American Dental Association, will head a new committee on problems in the field of oral surgery. Others on the committee are immediate past president Leslie M. FitzGerald of Dubuque, Iowa; James R. Cameron of Philadelphia; Fred A. Henny of Detroit; Paul H. Jeserich of Ann Arbor, Mich., and O. J. McCormack of Syracuse, N. Y. Bernerd C. Kingsbury of San Francisco, Association president-elect, will serve as consultant to the committee.

■ Association of Military Surgeons Renames Magazine

The journal of the Association of Military Surgeons of the United States, known as *The Military Surgeon,* has been renamed *Military Medicine* beginning with the January issue. The Association believes the new name better covers the scope of the journal.

■ Paul Scheman Appointed Hillside Dental Director

Paul Scheman of Brooklyn, a diplomate of the New York State Board of Oral Surgery, has been appointed director of dentistry at Hillside Hospital in Glen Oaks, N. Y. He succeeds the late Barnett A. Kessler, who organized the dental department 12 years ago to provide dental care for the emotionally disturbed patient.

Dr. Scheman is a fellow of the Long Island Academy of Odontology and a member of the New York Institute of Oral Pathology. In addition to his post at Hillside Hospital, Dr. Scheman is in charge of oral pathology at Queens General Hospital.

■ List Problems of Dentistry to Be Discussed By F.D.I.

Hospital dental services, dental education and the dental services of the Armed Forces of various countries will be on the agenda of the August 14-20 annual meeting of the Fédération Dentaire Internationale. The meeting is scheduled for Copenhagen, Denmark. In addition to the general assemblies of delegates from the national member associations, the F.D.I. councils and commissions will meet. An extensive scientific program of films, lectures and panel discussions is planned as well as a special workshop of experts in periodontology.

Registration before May 1 will be at normal fees, W. Riis Klausen, secretary of the organizing committee, has announced. After the May 1 date, registration will be at a higher rate. Further information on the meeting and on hotel reservations can be obtained from Dr. Klausen, 1, Alhambravej, Copenhagen 5, Denmark.

■ European Dental Groups, Mexican Study Club Announce Meetings

Among meetings taking place in Europe during the year which are of interest to dentists are the July 4-8 meeting of the British Dental Association in Glasgow, Scotland; the July 11-14 meeting of the American Dental Society of Europe in Amsterdam, Holland, and the Second Panhellenic Congress and Council meeting September 25-30 in Athens, Greece. Information on the British meeting may be obtained from the secretary of the British Dental Association, 13 Hill St., Berkeley Square, London W. 1; on the meeting of the American Dental Society of Europe from J. Moloney, 110 Harley St., London W. 1, and on the Panhellenic Congress from B. Stefanopoulos-Vrettos, 71 Skoufa St., Athens.

In Mexico, the Grupo de Estudios Dentales del Universidad del Sur de California has scheduled its eighth annual seminar. The meeting will be held May 15-19 in Tehuacan, Puebla, Mexico.

■ Sponsor First Cuban Congress of Oral Surgery

April 25 and 26 are the dates of the First Congress of Oral Surgery of Cuba, announces the Asociación de Cirujanos Orales de Cuba, the sponsoring organization. The Congress will be held at the Edificio Retiro Odontológico, Calle L No. 353, Vedada, Havana, Cuba. Information on the meeting may be obtained from president C. Funcia Cornell or secretary Pantaleón García.

■ New York Hospitals Offer Internships, Residencies

Internships and residencies are offered at two New York hospitals. The department of dentistry of the Bronx Municipal Hospital Center announces four rotating dental internships and two residencies in oral surgery. Application forms may be obtained from the director of the dental department, Bronx Municipal Hospital Center, Morris Park Ave., East Chester Rd., The Bronx 61, N. Y.

The dental and oral surgery service of Mount Sinai Hospital is offering a one year residency in oral surgery for the year beginning July 1955. Information on the residency may be obtained from Jack Ruthberg, M.D., assistant director of the hospital, 5th Ave. and 100 St., New York 29.

■ University of Toronto Offers Oral Surgery Course

A course in dental oral surgery and anesthesia is being offered May 2-6 by the Faculty of Dentistry of the University of Toronto. Information may be obtained from the dean of the Faculty, University of Toronto, Toronto, Ontario, Canada.

■ Illinois Offers One Year Internship In Oral Surgery

A one year internship in oral surgery beginning July 1, 1955, is offered by the University of Illinois Research and Educational Hospitals in Chicago. A minimal stipend is provided as well as residence at the hospital with room, board, laundry and uniforms. Emphasis will be placed on the practical aspects of oral surgery for both inpatient and outpatient service. Inquiries may be addressed to D. J. Caseley, M.D., medical director, University of Illinois Research and Educational Hospitals, 840 S. Wood St., Chicago.

Editorial communications

■ ORIGINAL COMMUNICATIONS—This journal invites concise original contributions in the broad field of clinical and experimental surgery of the mouth and associated structures, including roentgenology, diagnosis, anesthesia and oral surgical pathology. Articles are accepted for publication with the understanding that they are contributed solely to the JOURNAL OF ORAL SURGERY. All manuscripts are subject to editorial modification. Neither the editors nor the publishers accept responsibility for the views and statements of authors expressed in their communications.

■ MANUSCRIPTS—Manuscripts submitted for publication should be sent to Fred A. Henny, Editor, Henry Ford Hospital, Detroit, Michigan.

Manuscripts should be typewritten on one side of the paper only with double spacing and liberal margins. The author's name and the abbreviated title of the article should appear at the top of each manuscript page. The original should be sent to the editor and a carbon copy retained by the author. Manuscripts will not be returned if accepted for publication.

References should be placed at the end of the article and should conform to the style of the Quarterly Cumulative Index Medicus; viz., name of author, title of article and name of periodical with volume, pages, month and year. They should be numbered and should appear in the same order as that of the superior figures inserted in the appropriate positions in the text.

■ ILLUSTRATIONS—Illustrations accompanying manuscripts should be unmounted and numbered. The author's name should appear on the margin or back.

Authors should insert figure numbers at appropriate places in the text. The original drawings, or glossy print photographs of them, should accompany the manuscript. Legends for illustrations are to be typewritten in a separate list with numbers corresponding to those on the photographs and drawings.

A reasonable number of halftone illustrations will be reproduced free of cost to the author, but special arrangements must be made with the editors for color plates, elaborate tables or extra illustrations. Copy for zinc cuts (such as pen drawings and charts) should be drawn and lettered in India ink or with black typewriter ribbon (carbon paper placed with carbon against back of sheet for bolder type). Ordinary blue or colors will not reproduce. Only good photographic prints or drawings should be supplied for halftone work.

■ CASE REPORTS—Case reports will constitute an important department of the journal and the editors welcome case reports that are of unusual clinical value or that present exceptional conditions of interest.

■ EXCHANGES—Letters, exchanges, reprints and all other communications relating to the JOURNAL OF ORAL SURGERY should be sent to the American Dental Association, 222 East Superior Street, Chicago 11.